T 33

Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

VOLUME I.
NUMBER 2.

CHICAGO, FEBRUARY, 1901.

10 CENTS A COPY.
50 CENTS A YEAR.

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TELEPHONE SUPPLY COMPANY
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19 SOUTH CANAL STREET, CHICAGO.

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355 DEARBORN STREET, CHICAGO, ILL.

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Efficiency, Material and Workmanship Guaranteed.
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PROMPT SHIPMENTS
LARGEST AND MOST COMPLETE STOCK
ELECTRIC APPLIANCE COMPANY
92 & 94 WEST VAN BUREN STREET
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ELECTRICAL SUPPLIES

WATER MOTORS
For driving Telephone Generators in Telephone Exchanges.
Over one hundred of these motors in use by the Central Union Telephone Company. Address
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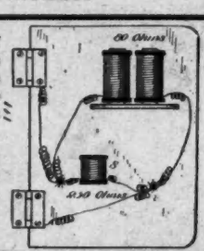
The use of these shunts makes a series grounded line as good as a bridged line.

Inductive and non-inductive resistance made at short notice.



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Discounts in quantities.

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CHICAGO TELEPHONES SATISFY.
CHICAGO TELEPHONE SUPPLY COMPANY, CHICAGO, ILL., U. S. A.

AMERICAN
STORAGE CELLS ARE THE BEST
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AMERICAN BATTERY CO.
172 S. CLINTON ST., CHICAGO, ILL.
ESTABLISHED 1889

THE LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.
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DEARBORN ELECTRIC CO.
CHICAGO.
WRITE FOR CATALOGUE AND PRICES.

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TELEPHONE ENGINEERS AND CONTRACTORS,
1259 MONADNOCK BUILDING
CHICAGO, ILLINOIS.
WRITE FOR OUR REFERENCES.

BIG FOUR ROUTE
BEST LINE
CHICAGO
TO
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TELEPHONES

No. 97. New Century Telephone.

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Get Our Prices.

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Highest Grade.

No. 97. New Century Telephone.

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Highest Grade.

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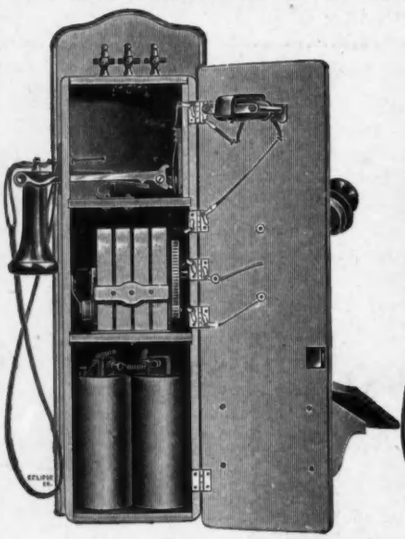
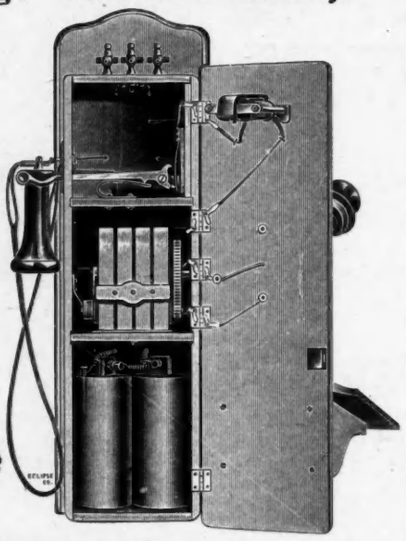
Get Our Prices.

New Members of the Already Large EUREKA Family.





Not a Black Sheep in the Whole Crowd.

Write Us.

—

Get Our Large Catalogue.

Write Us.

—

Get Our Large Catalogue.

SWITCHBOARDS

NOTICE—On Feb. 15th, 1901, we remove to the Eureka Electric Building, 143-145 S. Clinton St., 6 floors, all devoted to the manufacture of THE HIGH-GRADE EUREKA APPARATUS.

EUREKA ELECTRIC CO.

157-167 S. Canal St.
CHICAGO, U. S. A.

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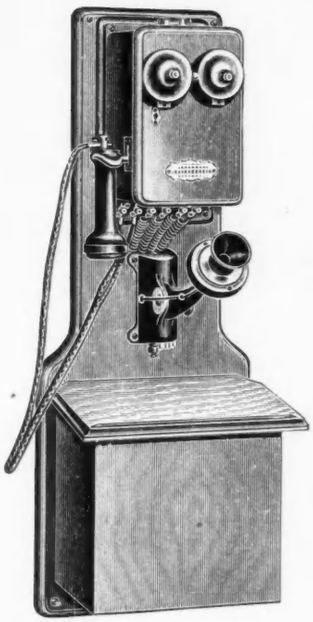
Chicago Telephones Satisfy, Of Course!



Bridging Apparatus is a specialty with this factory.

While others experiment

WE KNOW HOW.

CHICAGO BRIDGING TELEPHONES

will be furnished in any style of cabinet desired.

A postal card will bring an illustrated folder containing full details of construction.

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Office and Factory:

Canal and Washington, - CHICAGO.

Chicago Telephones Satisfy, Of Course!

Try one and be convinced.

The talking circuit is unexcelled in the exact reproduction of articulate sounds.

The Chicago Solid Back Transmitter and **Bi-Polar Receiver** are a good pair to draw to.

They Can't Be Beat,

Our customers are testifying right along. Would you like to see a few copies of recent letters? Write us.

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Office and Factory:

Canal and Washington, - CHICAGO.

Chicago Telephones Satisfy, Of Course!

Ask your neighbors.

Up-to-date Toll Line Companies everywhere are using exclusively

CHICAGO MODEL 17.

The Generator has Laminated Armature, Laminated Field Magnets, and produces a large volume of current at a high potential for ringing over heavily loaded lines.

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Office and Factory:

Canal and Washington, - CHICAGO.

Chicago Telephones Satisfy, Of Course!

A sample will cost you nothing if it does not please you.

Write for sample order proposition.

Chicago Bridging Telephone,

MODEL 17,

is the acme of perfection.

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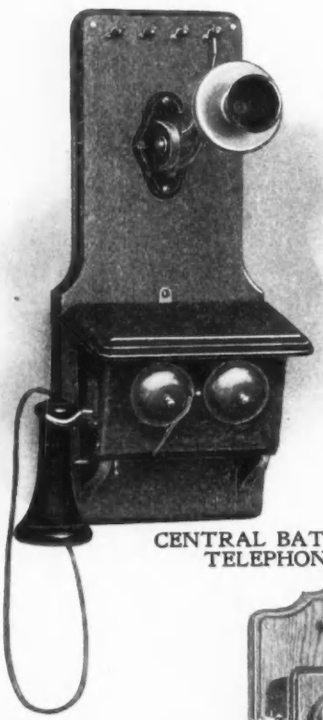
MANUFAC

TELEPHONES, SWITCHBOARDS,

FOR SMALL OR



CENTRAL BATTERY TELEPHONE.

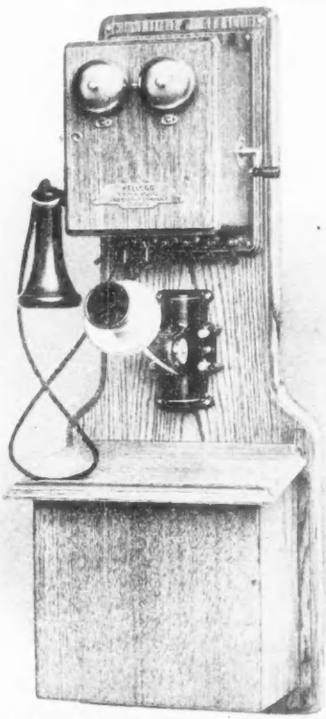
KELLOGG TELEPHONES

FOR

NEATNESS OF DESIGN, SKILL IN CONSTRUCTION, ECONOMY OF OPERATION, AND EFFICIENCY, HAVE NO EQUAL.

THEY HAVE LONG-DISTANCE TRANSMITTERS AND RECEIVERS.

MOUTHPIECES AND RECEIVER SHELLS ARE OF BEST QUALITY HARD RUBBER.



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ALL HOOK-SWITCH SPRINGS ARE PLATINUM POINTED.

WOODWORK IS OAK OR WALNUT AS DESIRED.

THEIR COST IS AS LOW AS ANY GOOD TELEPHONE ON THE MARKET.

EVERY INSTRUMENT IS SENT OUT WITH OUR GUARANTEE.

DRY BATTERY TYPE WALL TELEPHONE

SEND FOR OUR BULLETIN No. 2, DESCRIBING SMALL SWITCHBOARDS.

PORTABLE DESK TELEPHONE.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

BOARD and SUPPLY CO.

TURERS OF

AND COMPLETE EQUIPMENTS,

LARGE EXCHANGES.

WE ARE PREPARED TO FURNISH
ON SHORT NOTICE BEST QUALITY

FINE MAGNET
ANNUNCIATOR
JUMPER

WIRE

AND
SWITCHBOARD
CABLE.

OF OUR OWN MANUFACTURE.

ANY SILK OR COTTON INSULATED WIRE
MADE TO ORDER.

STANDARD PRODUCTS IN STOCK.

FACTORY AND GENERAL OFFICES,

239 SOUTH GREEN STREET, CHICAGO.

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The North Electric Co.

POSITIVELY

THE

First Appearance

OF OUR

PEERLESS TRIO

In their New Opera Entitled

"To Win Thee Favor"

The North Electric Co.

DEPICTING

THE

Downfall of The Telephone Imp.

Book of the Opera Handsomely Bound, Sent Free on Request.

STAR CAST:

Mr. "F" Desk Set

Compact and Complete.

Mlle. Type "E"

Smallest and Prettiest Magneto Call Wall Set in the World.

Mr. Twin Set

With Hosts of Admirers.

AND

HIS MAJESTY

***The* Telephone Imp**

Now at Large.

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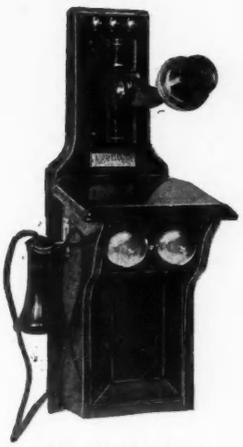
FULL CHORUS

Consisting of Beautiful and Attractive Specialties needed in every Telephone Exchange or Toll Line System.

Permanent Address:

69-79 Frankfort Street
Cleveland, O.

The North Electric Co.



TYPE "C" WALL SET.

The North Electric Co.

ASSISTED BY

The Following Artists,

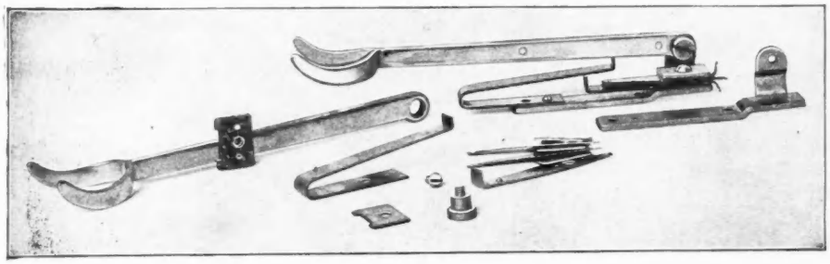
THE ACKNOWLEDGED

LEADERS:

Lady "Type C Wall,"

Recently Appearing in the now Celebrated

"The North Supervisory System."



Mr. Automatic Switch,

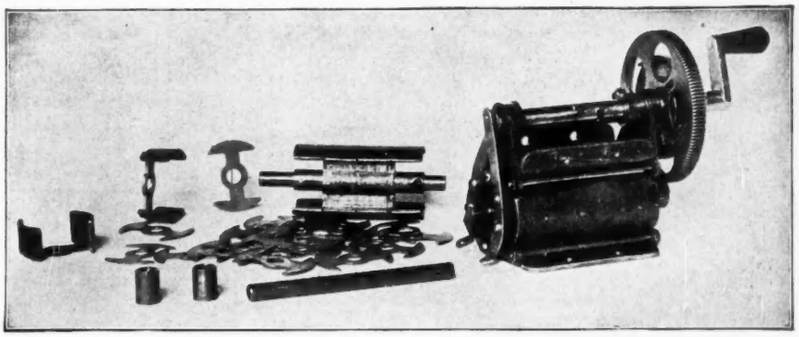
Whose Mica Insulated and Interchangeable Parts have won the admiration of the "Wizards" and defied the "Electric Fluid."

Mlle. Laminated Armature,

In her Sensational

WHIRLING ACT,

The only danseuse who can cut her entire Magnetic Field with her "automatic shunt" and throw her entire current onto the line. A UNIVERSAL FAVORITE WITH THE CRITICS.



AND

Mr. Hardshell Receiver,

Appearing in his pure, blown rubber case. His adjustable insides are securely locked and always keep their place, despite the coaxing of an inquisitive public--ALWAYS THE SAME.

ALL OF OUR ARTISTS

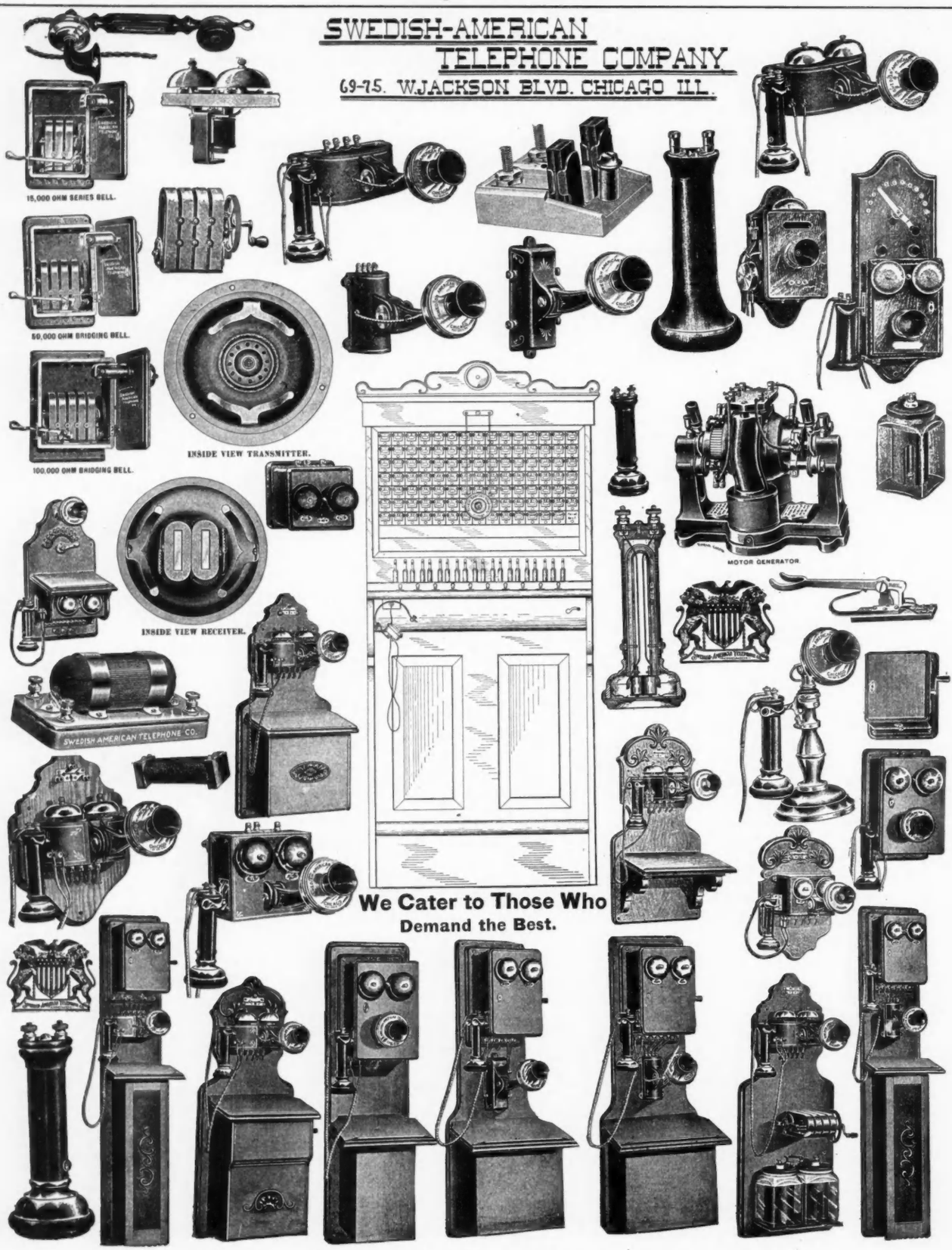
Appear in full series and bridging costume of finest quality and finish.

WESTERN BOOKING OFFICE:
1511 MONADNOCK BLK., CHICAGO.

Permanent Address,
69-79 Frankfort St., . CLEVELAND, OHIO.

INTERIOR VIEW.

The North Electric Co.



The above cuts show a few of our different types of apparatus. We have many more.

FULL MULTIPLE CENTRAL ENERGY FLASH LIGHT SWITCHBOARDS FOR LARGE EXCHANGES.

MECHANICAL TARGET BOARDS FOR SMALL EXCHANGES.

INTERCOMMUNICATING SYSTEMS. A FULL LINE OF SUPPLIES.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

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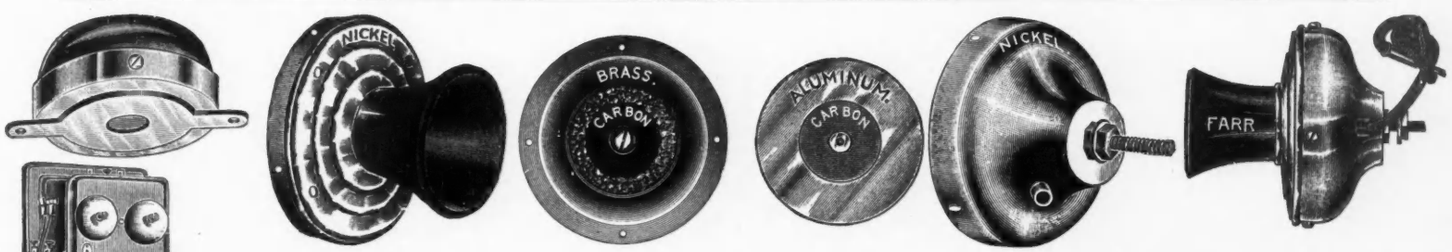


FARR TELEPHONE & CONST. SUPPLY CO., CHICAGO, ILL.

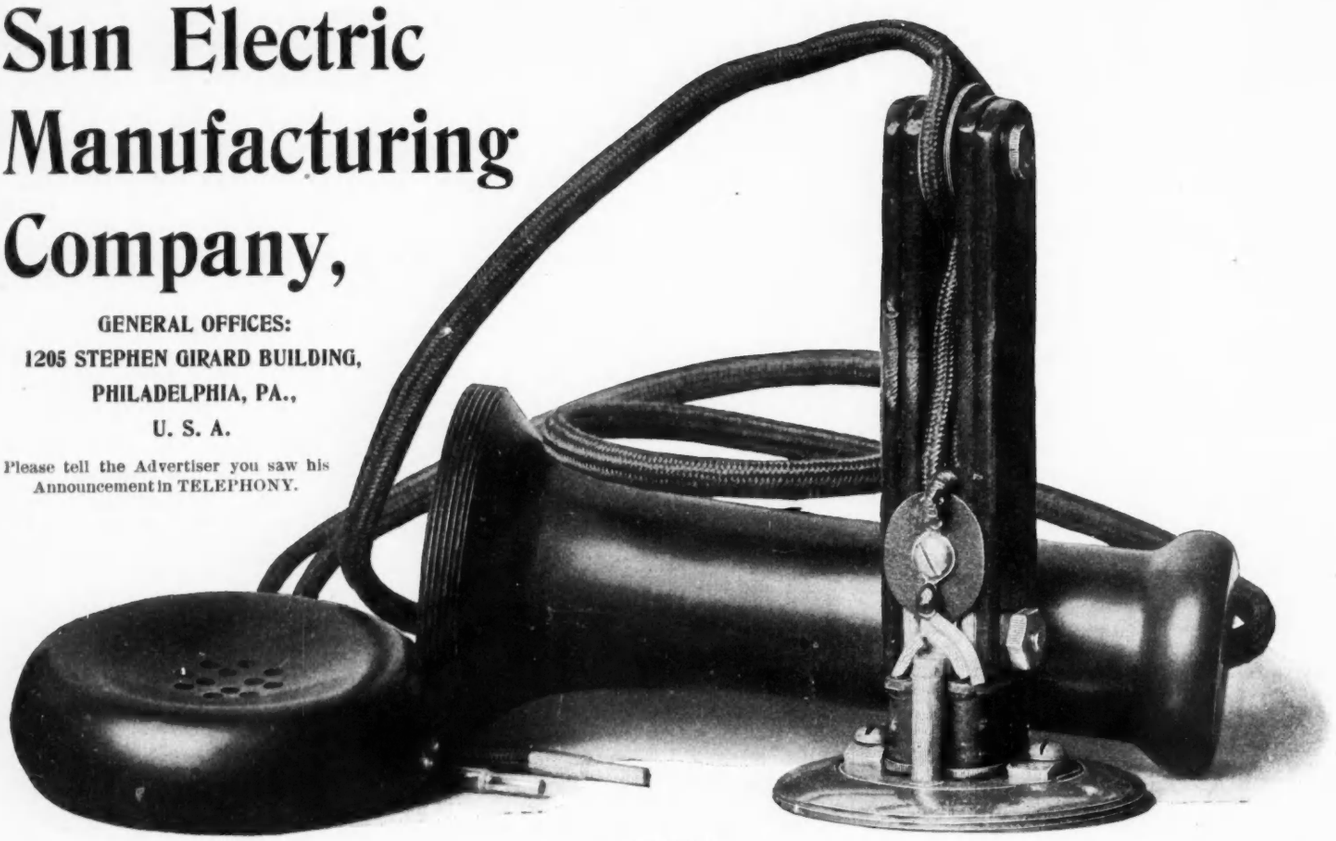
WE HAVE A LARGE STOCK OF TELEPHONES AND SUPPLIES
WE CATER TO THE INDEPENDENT TELEPHONE TRADE. WE WANT YOUR TRADE. WE GUARANTEE EVERYTHING WE SELL.
Orders Shipped Promptly. Our prices are low. Give us a trial order

SEND FOR OUR CATALOGUE. 333 ILLUSTRATIONS WITH DIAGRAMS OF WIRING

Sun Electric Manufacturing Company,

GENERAL OFFICES:
1205 STEPHEN GIRARD BUILDING,
PHILADELPHIA, PA.,
U. S. A.

Please tell the Advertiser you saw his Announcement in TELEPHONY.



CUT NO. 2.

RECEIVER. Cuts Nos. 1 and 2. Our receiver is a new departure, like the transmitter. Examine it carefully. It has a genuine hard-rubber shell, of very desirable design, with a cap that is novel in that it contains a series of small perforations instead of the single large opening heretofore used by others. The magnet structure is made as a unit, assembled and adjusted without regard to the shell. The magnet steel is very efficient, specially made for us under a formula guaranteed to perfectly preserve its magnetism at full strength. The cord is secured to the magnet structure, and there are no external binding posts. The entire magnet structure is carried on a metal disc adjustable in a metal ring which carries the diaphragm, and the construction is mechanically and electrically perfect.

As for the talking qualities of these instruments, they are superior to others.

CUT NO. 3.

CUT NO. 4.

TRIPLET SETS. Cuts Nos. 3 and 4 show Triplet Sets. The operative parts of the telephone proper are contained in what we call our Triplet box. We originated this box and have had it in use several years with satisfaction to ourselves and customers. It consists of a rectangular casting with open front, to which we fit either a plate-glass or cast-iron cover. The glass front box (Cut No. 3) enables a constant inspection to be had of all parts of instrument, which are nickel-plated and polished. In the iron front they are nickel-whitened, but are otherwise the same. Mounted in Triplet Sets are our Standard Switch Hook, Ringers, and Induction Coil. Mounted on the top of the box is a saddle having a cone-bearing hinge in which turns the transmitter arm This arm is hollow and the transmitter cords are therefore concealed. The pivot screws and fittings of the arm hinge are finely nickeled, as are all the fittings of our instruments.

Sun Electric Manufacturing Company

The cuts on this page show the Sun standard telephone instruments—one type of wall set which we call "Type A," glass front, and one type of portable desk set which we call "Type D," with rubber grip. This wall set has our well known triplet box, with heavy plate glass front, mounted upon a handsome backboard of entirely original design. All metal parts inside the triplet box are heavily nickel-plated and polished. The workmanship on all parts is of the finest, and we think we have a right to say that these are the handsomest telephones that have ever been produced, bar none.

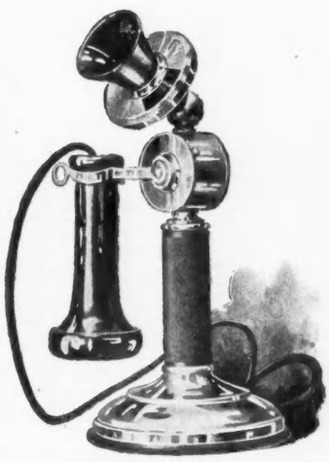
One of the cuts shows the battery box removed. Observe that the generator and the battery tray are carried directly on the backboard. This makes them accessible, as well as rendering the attachment solid and permanent.

In our desk set we put the switch hook where it belongs, at the top of the vertical column, and we put a crystal in the box so you can see into it. We make fine apparatus and we want to show every part of it.

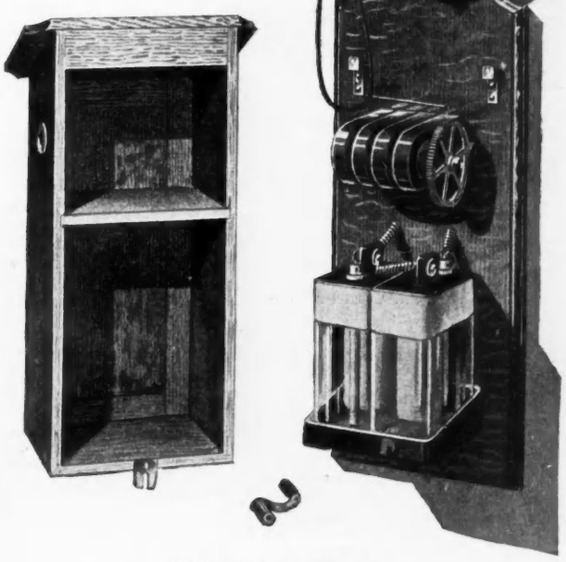
Note in both of these instruments that all transmitter wiring is concealed. The conductors are two cords led through a hollow arm and a boss respectively. When you screw our transmitter on its nipple, you automatically make the connections without fooling with any wires or cords.

If you need any telephones, give us a trial order. Our instruments sing their own praises, and we want you to join in the chorus.

Wall Set, Type A, Closed.



Sun Portable Desk Set, Type D.



Wall Set, Type A, Open.

We design and manufacture many types of telephones beside the above and all sorts of telephonic apparatus, and it is all absolutely high-grade. Whether you want switchboards or instruments, and whether you want them for some special purpose or not, write to us and give us a chance to figure with you. It is a hundred to one that we can supply just what you want, and a very important fact to remember is, that

OUR PRICES ARE RIGHT.

Sun Electric Manufacturing Company,

GENERAL OFFICES: 1205 STEPHEN GIRARD BUILDING. PHILADELPHIA, PA., U. S. A.

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INDEPENDENT TELEPHONE SUPPLY COMPANY

We have on hand for immediate delivery
10 Bridging Telephones, $9.50 ea.
50 Series Telephones, 7.50 "
10 Desk Set Telephones, 5.50 "
Above are practically new; in first class condition and of well known make.

TELEPHONE CONSTRUCTION SPECIALTIES AND SUPPLIES

19 SOUTH CANAL STREET, CHICAGO

COMPLETE STOCK *PROMPT SHIPMENTS*

"MONARCH" GALVANIZED TELEPHONE WIRE
"EXTRA BB" and "BB" GALVANIZED TELEPHONE WIRE
HARD-DRAWN COPPER TELEPHONE WIRE
RUBBER-COVERED WIRE
WEATHERPROOF IRON LINE WIRE
ANNUNCIATOR WIRE
OFFICE WIRE
GALVANIZED STEEL STRAND
CROSBY CLIPS GUY CLAMPS
BOSTON CABLE HANGERS
TURNBUCKLES

MESSENGER POLE SUPPORTS
GALVANIZED THIMBLES
GUY RODS GROUND RODS
STOMBAUGH GUY ANCHORS
EYE BOLTS
CROSS-ARMS
CROSS-ARM BRACES
PINS and BRACKETS
LAG SCREWS AND BOLTS
INSULATORS KNOBS
TOOLS, ETC., ETC.

Century Telephone Construction Company,

CLEVELAND, OHIO.

MANUFACTURERS OF

Highest Standard Up-to-Date Telephone Apparatus and Accessories,

DESK TELEPHONES
(Neat and Attractive in Design)

WALL TELEPHONES
Series and Bridging,
(HONESTLY AND SUBSTANTIALLY BUILT.)

Intercommunicating and Interior Systems.

Switchboards, Cross-connecting Boards, Terminal Heads,
(BEST IN THE MARKET)

Transmitters,
"CAN'T PACK,"

BIPOLAR RECEIVERS,
Etc., Etc., Etc.

We Install Telephone Exchanges Complete.

CORRESPONDENCE SOLICITED. WRITE US FOR CATALOGUE AND PRICE LIST.

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American Telephone Practice

By KEMPSTER B. MILLER, M. E.

$3.00 518 large pages, profusely illustrated, with 379 diagrams and cuts of apparatus. **$3.00**

The London (England) Electrical Engineer says: "This is a book the like of which could not have been produced in this country."

No live telephone man can afford to be without it, as it is a perfect encyclopedia of useful information concerning telephony.

It gives complete specifications, enabling you to intelligently order apparatus or supplies from manufacturers or to properly supervise the installation of an exchange, large or small.

It describes in simple language the theory and practice of modern telephony, including the circuits, mechanical construction and operation of telephones and switchboards.

A complete description is given of storage batteries, their care and maintenance; of aerial and underground line construction, and, in fact, all the important matters which telephone men need to know.

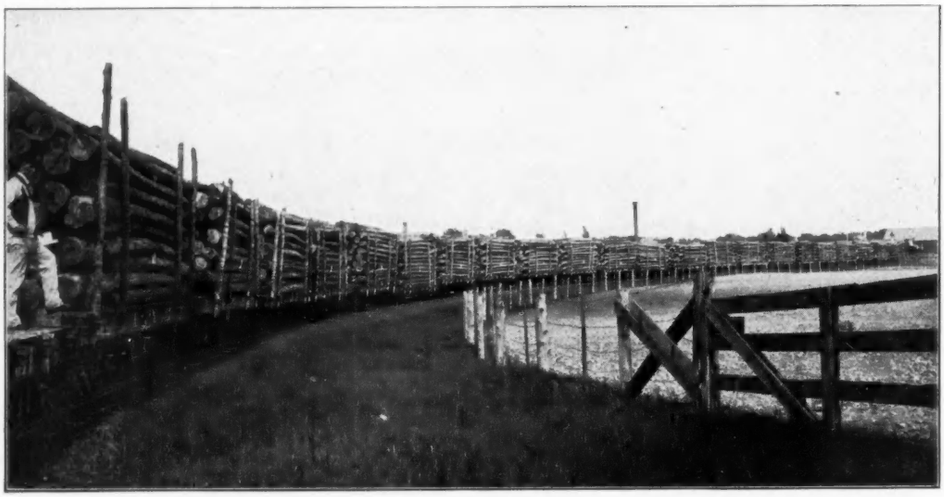
The Telephone Book of the Century.

FOR SALE BY TELEPHONY,

Manhattan Building, Chicago, Ill., U. S. A.

CEDAR POLES

CEDAR POLES



CEDAR POLES

THE VALENTINE-CLARK CO.,
234 LASALLE STREET,
CHICAGO.

YARDS:
GREEN BAY, WIS.
NEW LONDON, WIS.

YARDS:
PRENTICE, WIS.
PINCONNING, MICH.

CEDAR POLES

PITTSBURG AND LAKE SUPERIOR IRON CO.,
Producers and Wholesalers,
ESCANABA, MICH.

CEDAR POLES

CEDAR POLES.

PILING AND STREET R. R. TIES.

WE OWN LARGE TRACTS OF CEDAR TIMBER AND PRODUCE IN OUR OWN CAMPS ABOUT ALL THE MATERIAL WE HANDLE.

C. H. WORCESTER CO.

MARINETTE, WIS.

WM. MUELLER COMPANY, CHICAGO, ILL. **CEDAR POLES.**

YARDS: Metropolitan, Mich., Raber, Mich., Chicago, Ill., Spalding, Mich., Flat Rock, Mich.

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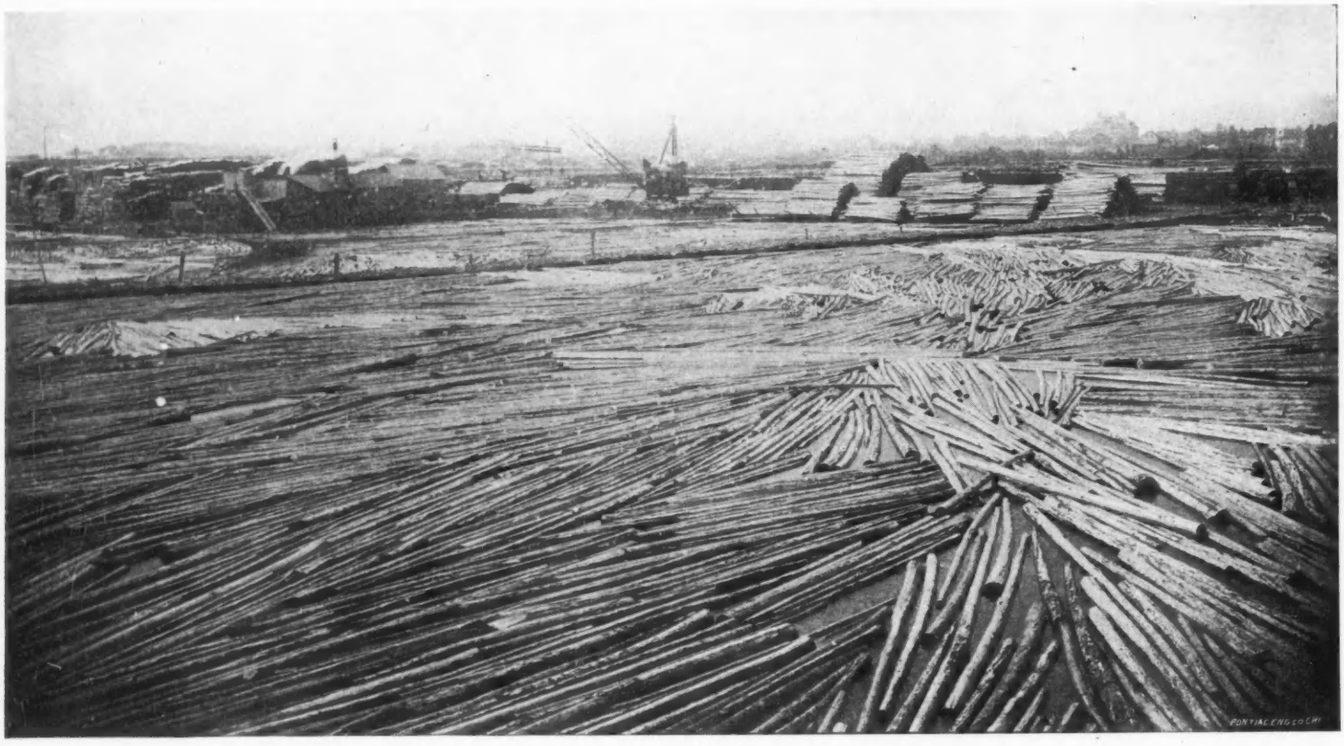
CEDAR POLES.



RABER & WATSON,

293 DEARBORN STREET, CHICAGO.
YARDS: CHICAGO, ILL., MENOMINEE AND CHEBOYGAN, MICH.

Carney Brothers Company

CEDAR POLES

CEDAR POLES

GENERAL OFFICES:
612 Chamber of Commerce,
CHICAGO.

YARDS:
Duluth, Minn., Washburn, Wis., Ball Club, Minn., Deer River, Minn., Cohasset, Minn.

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ONE CENT

May bring you great returns if you will drop me a postal card stating when and where you want.....

CEDAR POLES.

Prompt Shipments from three central yards.
Eleventh consecutive year devoted to the pole business.

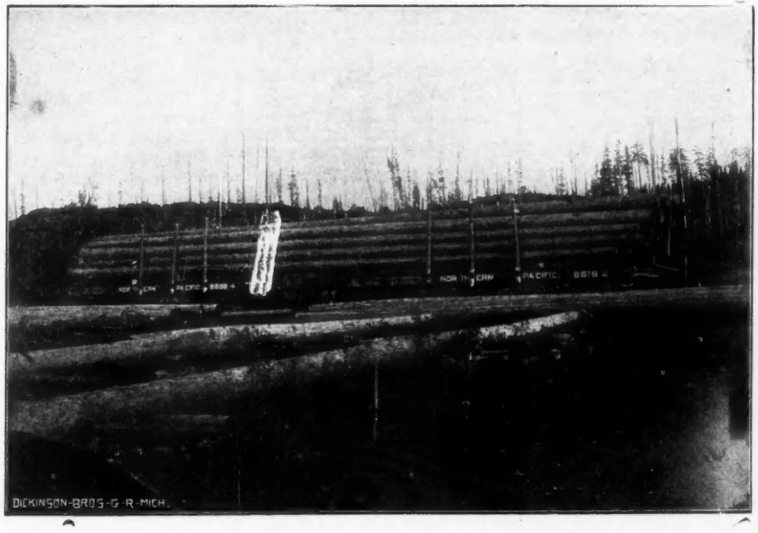
WRITE **O. W. SMITH,**

223-225 Dearborn Street, - - - - Chicago, Illinois.

White Cedar Poles

Lindsley Brothers Company, Menominee, Michigan.

GOOD STOCK AT LOW PRICES.
IMMEDIATE SHIPMENTS.



10,000 Dry Poles at Menominee Yard for Immediate Shipment. Write for Prices.

Lindsley Brothers Company, Menominee, Michigan.

Lindsley Brothers Company, Menominee, Mich.

WE MAKE A SPECIALTY OF LONG POLES, 50 TO 80 FEET.

OFFICES AND YARDS AT: **Menominee, Mich. Stephenson, Mich. Goll, Wis. Portland, Ore.**

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FISHER BUILDING,
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CEDAR POLES
50 TO 80 FEET A SPECIALTY.

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W. T. REYNOLDS,
1029-30 LUMBER EXCHANGE,
MINNEAPOLIS, MINNESOTA.

WHITE CEDAR POLES
ALL SIZES.
PACIFIC COAST POLES,
40 TO 80 FEET.

CEDAR TORREY CEDAR COMPANY, POLES
CLINTONVILLE, WIS.
LARGE STOCK CONSTANTLY ON HAND.

CEDAR POLES AND STREET CAR TIES.
WHOLESALE PRODUCERS.
PERRIZO & SONS, - DAGGETT, MICH.

W. C. STERLING & SON,
MONROE, MICH.
11 POLE YARDS IN MICHIGAN.
WHOLESALE PRODUCERS FOR 20 YEARS.
CEDAR POLES

THE TELEPHONE HAND=BOOK

NEW AND REVISED EDITION, WITH A NEW CHAPTER ON "RECENT PROGRESS," BRINGING THE BOOK UP TO DATE.

BY HERBERT LAWS WEBB.

160 Pages, 133 Illustrations, Cloth, Hand=Book Size . . . . . Price, $1.00.

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For Sale by TELEPHONY, Manhattan Building, Chicago, Ill., U. S. A.

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L. SANDS, President. J. M. GUNDRY, Sec'y and Treas. H. C. DODGE, General Manager.

THE WILLIAMS-ABBOTT ELECTRIC CO.,

CLEVELAND, OHIO, THE NEW TELEPHONE CENTER.

SOMETHING NEW IN TELEPHONES.

"SANDS' VICTOR"—(Closed).

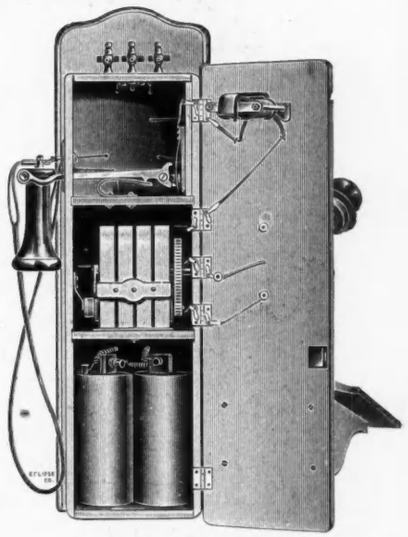
"SANDS' VICTOR."

This instrument is designed to meet a long-felt want for a handsome, compact wall set, perfect in all its details, with parts so arranged that the utmost ease of access is afforded for their inspection, adjustment and repair.

We never lose interest in the telephone that goes out of our factory. Its daily deportment is our deepest concern. We stand sponsor for it, and our sponsorship does not end when it passes into service. YOU BUY A GUARANTEE WITH THE INSTRUMENT, AND THE GUARANTEE IS GOOD.

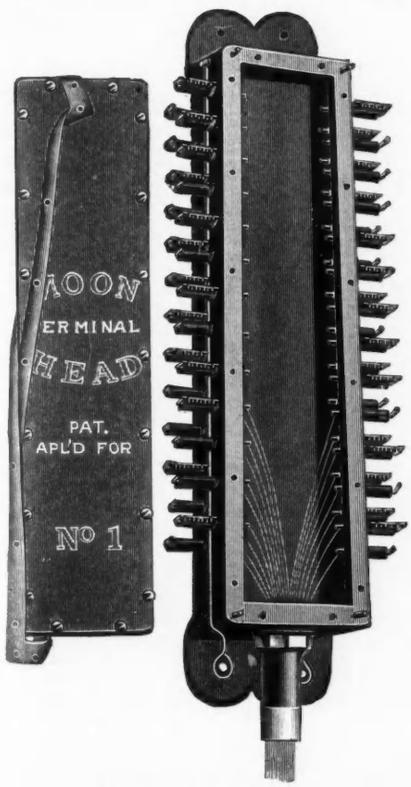
We Manufacture High-Grade Telephone Apparatus.

CORRESPONDENCE SOLICITED.



"SANDS' VICTOR"—(Open).

IMPORTANT



Fuse Terminal. Fig. 1.

Is Your Life Insured?

Is The Life of Your Cables Insured With a

MOON FUSE TERMINAL HEAD?

Nothing is more important in an exchange than proper protection for your cables. **THE MOON FUSE TERMINAL** furnishes it.

Lightning, trolley, electric light and all destructive electric currents, as well as the ever-present moisture which is lurking in every city or town, are baffled by the **MOON.** Address

43 SOUTH CANAL STREET, CHICAGO.

Outer Case Opened. Fig. 7

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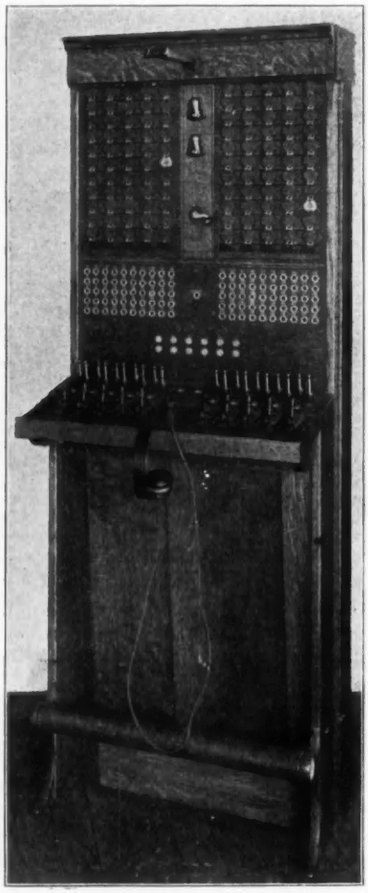
STERLING ELECTRIC COMPANY

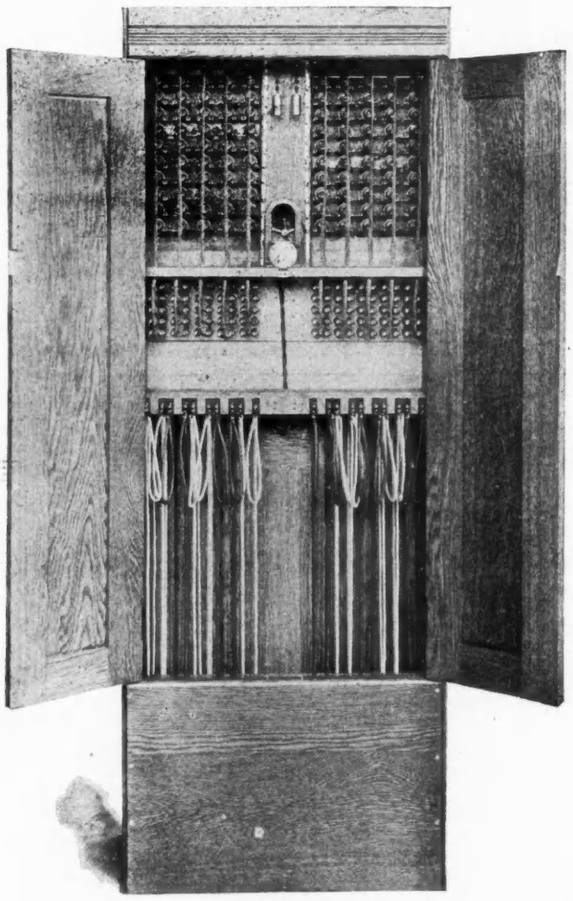
SWITCH

MULTIPLE

Full Common Battery, Batte



FRONT 100 DROP BOARD.



REAR 100 DROP BOARD.

Protectors

FOR { SWITCHBOARDS, CABLES, INSTRUMENTS, TOLL STATIONS.

MAIN OFFICE AND FACTORY:
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BOARDS.

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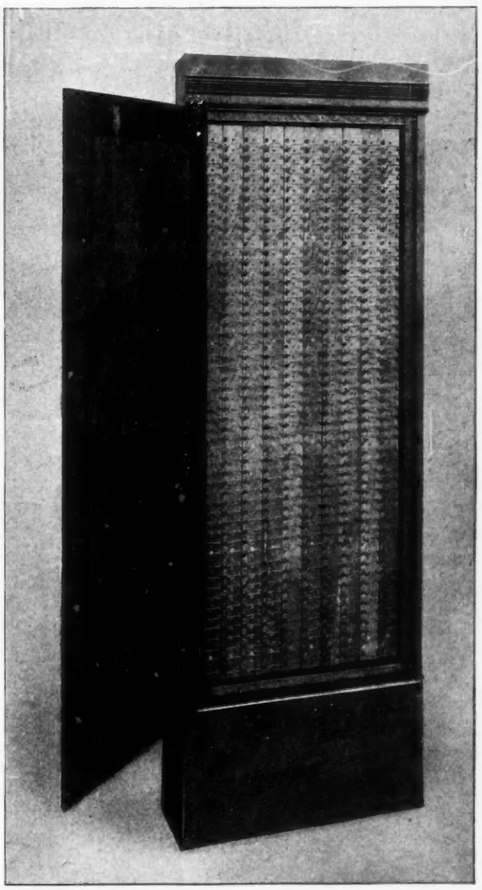
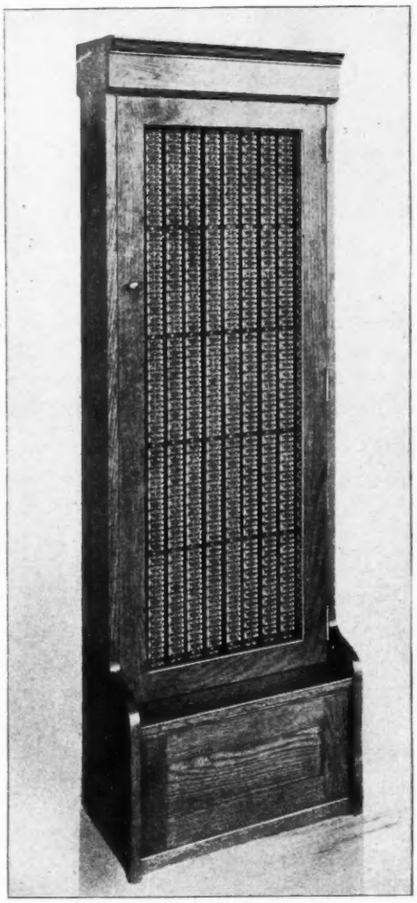
TRANSFER.

ry Calling, Generator Call.



REAR 500 METALLIC DISTRIBUTING BOARD.



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Telephones

FOR { EXCHANGE WORK,
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GENERATOR CALL WORK,
COMMON BATTERY WORK.

LECTRIC CO.

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STERLING ELECTRIC COMPANY

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CENTRAL ENERGY SYSTEM

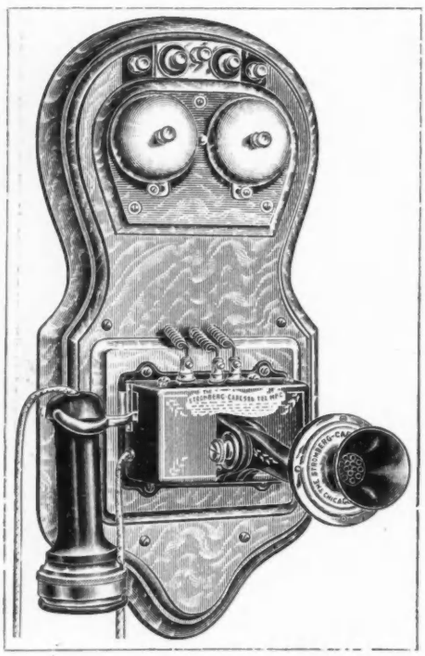
FOR

Large and Small Public and Private Exchanges.

MULTIPLE SWITCHBOARDS

For Any Size Plant.

Fully Patented.



Absolutely Non-Infringing.

All Equipment Fully Guaranteed.

CORRESPONDENCE SOLICITED.

THE STROMBERG-CARLSON TEL. MFG. CO.

70-82 W. JACKSON BOUL.,
CHICAGO, U. S. A.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

Telephony.

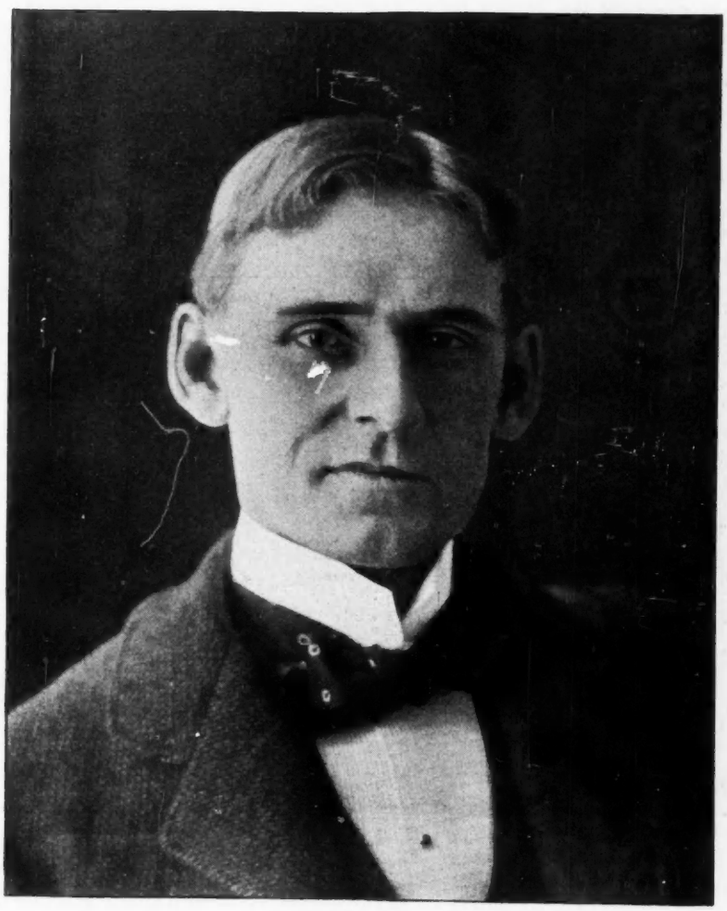
AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

VOL. I. CHICAGO, FEBRUARY, 1901. No. 2.

NORTHWESTERN CEDARMEN'S CONVENTION.

The Northwestern Cedarmen's Association convened in their third annual session at the Hotel Marinette in the city of Marinette, Wis., at 2 p. m., on January 9, 1901. About forty members, representing the leading cedar companies of the Northwest, were present. Following is the list of attendants:

H. S. Gilkey, Pendleton & Gilkey, Janesville, Wis.; Everett Gilkey, Pendleton & Gilkey, Janesville, Wis.; C. H. Worcester, C. H. Worcester Company, Marinette, Wis.; Paul Perrizo, Perrizo & Sons, Daggett, Mich.; W. J. Stitt, Davis & Stitt Company, Marinette, Wis.; J. K. Wright, Wright Bros., Marinette, Wis.; F. W. Robinson, Robinson & Co., Bovee, Mich.; W. B. Thomas, White Marble Lime Company, Manistique, Mich.; A. D. Watson, Raber & Watson, Chicago; A. V. Freeman, Raber & Watson, Chicago; M. K. Bissell, Erickson & Bissell, Escanaba, Mich.; J. H. Reinger, Escanaba, Mich.; H. W. Reade, Pittsburg & Lake Superior Iron Company, Escanaba, Mich.; J. C. Kirkpatrick, Pittsburg & Lake Superior Iron Company, Escanaba, Mich.; G. L. Lindsley, Lindsley Bros. Company, Menominee, Mich.; E. L. Clark, Valentine-Clark Company, Chicago; W. R. Mackenzie, Brittingham & Hixon Lumber Company, Madison, Wis.; Marshall Parkinson, Parkinson Cedar Company, Madison, Wis.; D. M. Fulmer, D. M. Fulmer Lumber Company, Florence, Wis.; F. J. Lang, Wisconsin Land & Lumber Company, Hermansville, Mich.; A. T. Naugle, A. P. Hopkins & Co.; Escanaba, Mich.; George R. Arnold, Mashek & Arnold, Escanaba, Mich.; M. Perron, Perronville, Mich.; F. C. Adams, Carney Bros. Company, Chicago; Ira Carley, Ingalls, Mich.; C. J. Huebel, C. J. Huebel & Co., Menominee, Mich.; A. W. Brandt, Faithorn Junction, Wis.; Daniel MacGillis, MacGillis & Gibbs, Milwaukee; William Mueller, William Mueller & Co., Chicago; W. T. Reynolds, Minneapolis, Minn.; O. W. Smith, Chicago, Ill,; Fred H. Gilman, Minneapolis; William H. Chambers, representing TELEPHONY.



C. H. WORCESTER.

The meeting was called to order by the president, H. S. Gilkey of Janesville.

Upon recommendation of a committee, appointed for the purpose, the following firms were unanimously admitted to membership:

Brittingham & Hixon Lumber Company, Madison, Wis.; A. P. Hopkins & Co., Escanaba, Mich.; William Mueller & Co., Chicago; Valentine-Clark Company, Chicago; O. W. Smith, Chicago.

President Gilkey delivered an admirable address, offering many valuable suggestions as to the course of action to be pursued by the association members for the coming year. This was followed by the annual report of Secretary Lang, in which he reviewed the work accomplished by the association during the year just closed. The treasurer, H. W. Reade, rendered a report, showing a balance of $617.35 on hand. The report of the treasurer was unanimously accepted, and Messrs. J. K. Wright, W. T. Reynolds and M. K. Bissell were appointed auditors.

The convention then practically went into an executive session, in which prices, inspections, rates, shortages and various other topics of a confidential nature were fully discussed. The proceedings were marked by vigorous, but good-natured discussion, and resulted in the appointment of the following committees:

Posts—C. H. Worcester, chairman; Daniel MacGillis, J. K. Wright, F. W. Robinson, W. T. Reynolds.

Shingles—W. B. Thomas, chairman; Ira Carley, M. M. Parkinson, J. H. Reinger, C. J. Huebel.

Poles—G. L. Lindsley, William Mueller, H. W. Reade, D. Reade, D. M. Fulmer, E. L. Clark.

The following price committee was appointed:

Posts and Shingles—C. H. Worcester, chairman; F. J. Lang, R. H. Downing, Daniel MacGillis, J. K. Wright.

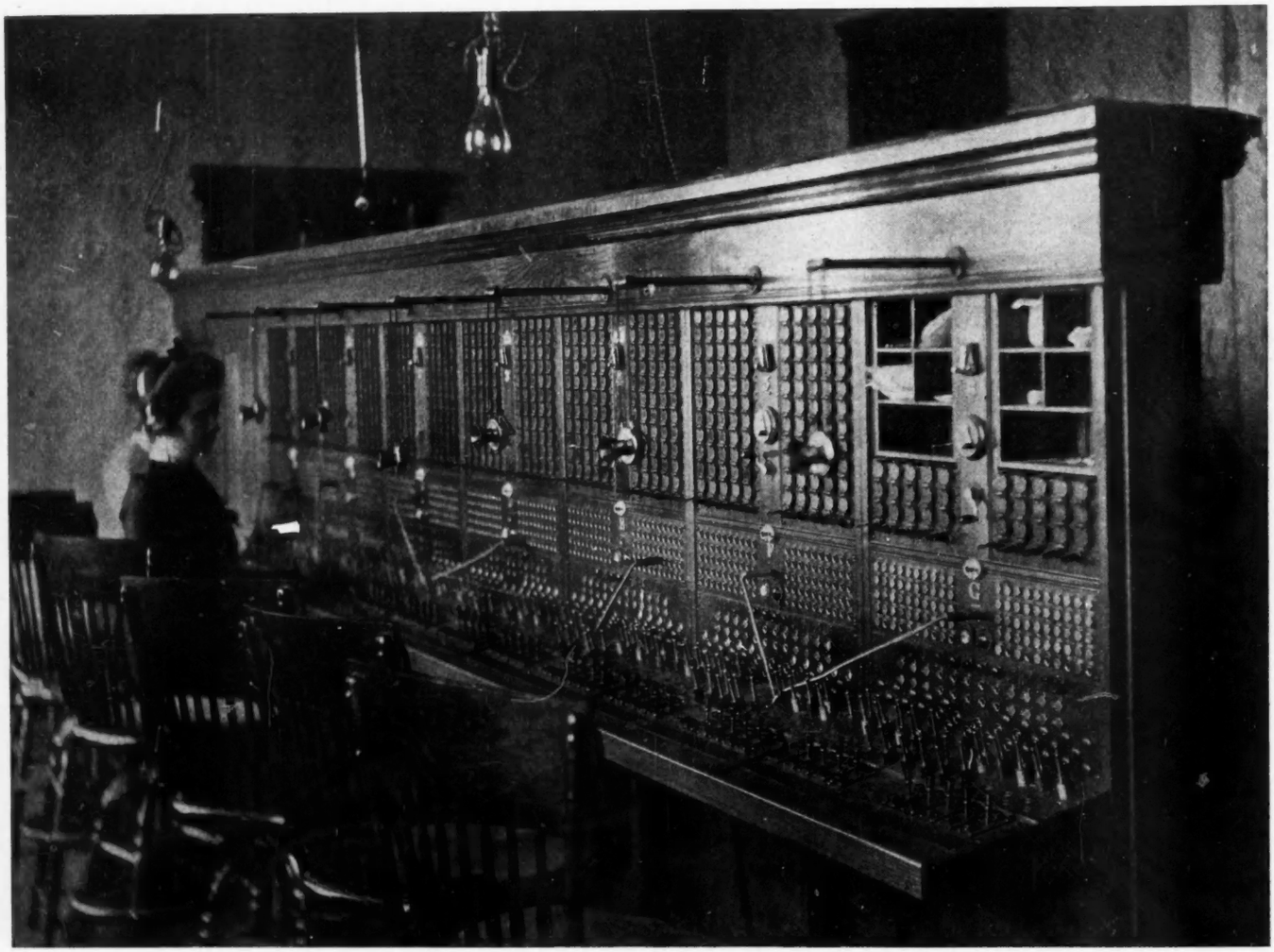
Poles—G. L. Lindsley, William Mueller, H. W. Reade, D. M. Fulmer, E. L. Clark.

(Continued on page 29.)

THE MARIETTA TELEPHONE COMPANY, MARIETTA, OHIO.

BY W. D. DUNNING, MANAGER.

Among the independent telephone exchanges constructed recently, the plant at Marietta, Ohio, installed by the Marietta Telephone Company, ranks high in the class of common battery systems. The officers and directors have spared neither time nor money to place before the public one of the most convenient and modern exchanges now in operation. Previous to the erection of this plant the ever high prevailing rates of the Bell Company were in vogue, and the service, like that in many other places, was very unsatisfactory. But now, owing to the support of the citizens of Marietta, the company is rapidly growing, and in the course of a few months will have complete control of the telephone field of Marietta and surrounding towns.



PART SECTION OF SWITCHBOARD MARIETTA TELEPHONE EXCHANGE.

The offices occupy the third floor of the Union block, situated on the corner of Front and Union streets, the building being specially adapted for the purpose of the company. The president, general manager, secretary and treasurer's offices, switchboard, terminal and cross-connecting room are all convenient for their respective uses. The total line capacity of the switchboard is thirteen hundred subscribers with seven hundred in actual use. In addition a toll board of one hundred line capacity is attached for state lines for nearby towns. The switchboard is of the latest common battery type, manufactured by the Sterling Electric Company of La Fayette, Ind., and contains many new improvements. The drops are of the latest enclosed shell style, using a Varley coil, which makes it very convenient in removing burned out coils and replacing new ones. They are wound to 200 ohms' resistance, using 26 volts for calling. Each board is equipped with ten sets of cords in conjunction with Cooke's ringing and listening key, each cord containing a supervisory lamp signal for clearing out. The trunking system is one of the most modern visual signals in use, each position with two outgoing jacks, terminating in plugs to all other boards, and two incoming lines from same boards, each trunk cord being governed by an individual lamp. The operator can at all times know the condition of lines in use over these circuits, from her position. In conjunction with the trunking jacks are two trunk supervisory lamps, red and green, by which the operator making a trunk call can tell as to how her transfer calls are being put up and taken down, the red remaining lighted until the cord called over is lifted and inserted in number desired. Then in withdrawing plug from trunk jack the green is lighted and remains so until plug is taken down and restored to its seat.

The storage system used for power in the exchange is the latest chloride accumulator cell, there being twenty-six in number, giving two respective voltages for calling and clearing out. The machines used for charging are two Crocker-Wheeler dynamos, driven by an Emerson alternating motor, a marble power switchboard being used for the various switching necessary to the board.

The terminals used are three hundred line Cooke protective terminal heads, in which the underground cables are terminated. The cables are furnished by the John A. Roebling's Sons Company, and are laid in four-duct conduits, one cable being recently laid across the Muskingum River for convenience of West Side subscribers.

This system is practically complete in every detail, and with ever courteous treatment to subscribers—always awake to the interest of all—there is no doubt as to the success of the exchange. The Independent Telephone Company has come to stay.

The Marietta Telephone Company has now under construction its own lines to Beverly, Lowell, Reno, Newport, St. Marys and Sistersville, and will soon lay a cable across the Ohio River, thereby connecting Williamstown and Parkersburg.

The exchange now has more than twenty-seven towns connected and will doubtless have as many more in the near future, as they intend to construct party lines for the use of the farmers in the surrounding country.

The illustration shows a portion of the switchboard,

GENERAL MANAGER'S OFFICE MARIETTA TELEPHONE EXCHANGE.

two sections having been added, after the photograph was taken, to accommodate the extra demand which was not anticipated.

The following officers and directors are putting forth every effort to deserve the credit bestowed upon them by the subscribers and patrons of the exchange. The full personnel of the company is as follows:

A. L. Gracey, president, Marietta, Ohio; J. S. H. Torner, vice-president, Marietta, Ohio; J. W. Dusenbury, secretary, Columbus, Ohio; E. Clark, Jr., treasurer, Marietta, Ohio; W. D. Dunning, manager, Columbus, Ohio; Sykes & Middleswart, counsel, Marietta, Ohio; Will J. Dusenbury, counsel, Columbus, Ohio; S. B. Ridge, superintendent of switchboard construction; J. C. Price, accountant. Directors—A. L. Gracey, J. S. H. Torner, E. Clark, Jr., Henry Strecker, J. W. Dusenbury.

The Michigan Independent Telephone Association will hold its annual convention in Lansing, Mich., on February 6, 1901. J. B. Ware, of Grand Rapids, Mich., is president of the state association and C. F. Brown of Alma, Mich., is secretary. It is expected there will be about seventy-five delegates in attendance. The report of the association statistician shows that during the past year the independent companies in Michigan have built three times as much copper lines, more new exchanges and put in, in the same proportion, as many new instruments, as in any previous year of their existence. The business of the different state companies is in a prosperous condition and the annual convention will likely be a large and enthusiastic one.

NORTHWESTERN CEDARMEN'S CONVENTION.

(Continued from page 27.)

The association also made arrangements for official inspections, which will undoubtedly prove advantageous to the different members.

The following officers were elected for the coming year:

President—C. H. Worcester, Marinette, Wis.
Vice-President—R. H. Downing, Minneapolis, Minn.
Secretary—Fred H. Gilman, Minneapolis.
Treasurer—H. W. Reade, Escanaba, Mich.

President Worcester, taking the chair, appointed the following committee to have charge of the official inspectors: William Mueller, chairman; R. H. Downing, J. K. Wright and H. W. Reade.

The following directors were elected: J. K. Wright, Paul Perrizo, M. M. Parkinson and J. C. Kirkpatrick.

The annual banquet was held at the Hotel Marinette at 8:30 p. m., and was attended by nearly every member of the association. President Worcester presided as toastmaster, and informal speeches were made by nearly every one present.

From any point of view, the convention was a great success, and the proceedings throughout were marked by the greatest harmony. You would rarely meet with a more representative set of business men, and it is safe to say that the Northwestern Cedarmen's Association is justly proud of all its members, and of the work they are doing.

THE TELEPHONOGRAPH.

The telephonograph promises to be one of the common conveniences of the coming century. As its name indicates, it is a combination of the telephone and the phonograph. A test of the new instrument was made in London recently, and it was found that messages could be taken and recorded by automatic means and even transmitted in the same manner. The phonographic action may be thrown out of play upon occasion and the telephone used in the ordinary way. The message is spoken, by the person sending it, into the telephone in the usual way, but the vibrations set up by the voice are caused by means of the impact of the sound waves to act upon a recording stylus. In this way the wax cylinder connected with the telephone of the sender is indented and a phonogram is produced which can be read off at leisure. If it be desired, the instrument may be so arranged that two wax cylinders or phonograms may be inscribed; the one being retained in the office of the sender and the other one reproduced exactly in the office of the receiver. The utility of this invention in business offices is apparent. It will save much time now consumed in dancing attendance on the telephone and the preservation of records of conversations will be an item of no small importance.

LINE CONSTRUCTION IN THE FROZEN NORTH.

A telephone line has been completed between Fort Smith, on the Slave River, and Graham Landing, in the Northwest Territories, Canada. It is 16 miles in length and runs through a dense forest. John Trewhella of Fort Simpson, on the Mackenzie River, who constructed the telephone system, states that it was necessary to clear about half the way of trees. In one place the ground was frozen to a depth of three feet below the surface, and it was necessary to brace all the poles in that portion of the line. It was impossible to dig a hole, as it was in swampy ground, and when a fire was used to thaw out the soil the water would soon put out the fire. Mr. Trewhella says: "This was in the month of August. In the winter we have it 60 degrees below zero, so I will have the opportunity of seeing how the line works then. I have just finished the job and it is working all right now."

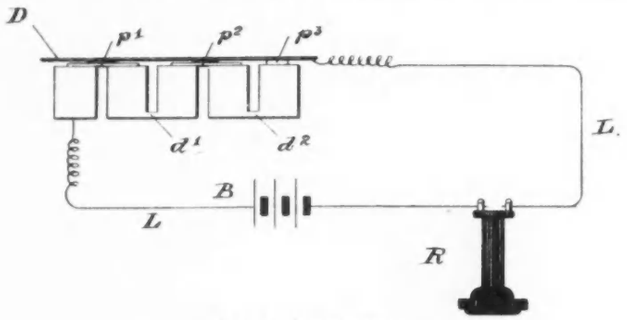
ILLUSTRATED DIGEST OF TELEPHONE PATENTS.

CONDUCTED BY EDWARD E. CLEMENT.

JANUARY 1.

No. 664,904.—A. H. Sköld. Microphone.

This is a telephone transmitter, having considerable resistance, intended to be used with common battery systems and no induction coil. Where the induction coil is omitted, it is, of course, desirable to have a high resistance transmitter, and one whose variations in resistance will be of considerable amplitude. To attain his ends, this inventor employs a number of electrode chambers containing granular carbon, and bridges across alternate electrodes by contacts on the diaphragm. The structural arrangement is very simple, the chambers being arranged in segmental form, so as to not occupy much more space than the ordinary carbon block and carbon diaphragm mechanism. The entire sets are arranged to form together a circular unit, surrounded by a ring of felt, while a circular middle electrode and the segmental chambers are separated by felt partitions. The contacts



664,904—MICROPHONE.

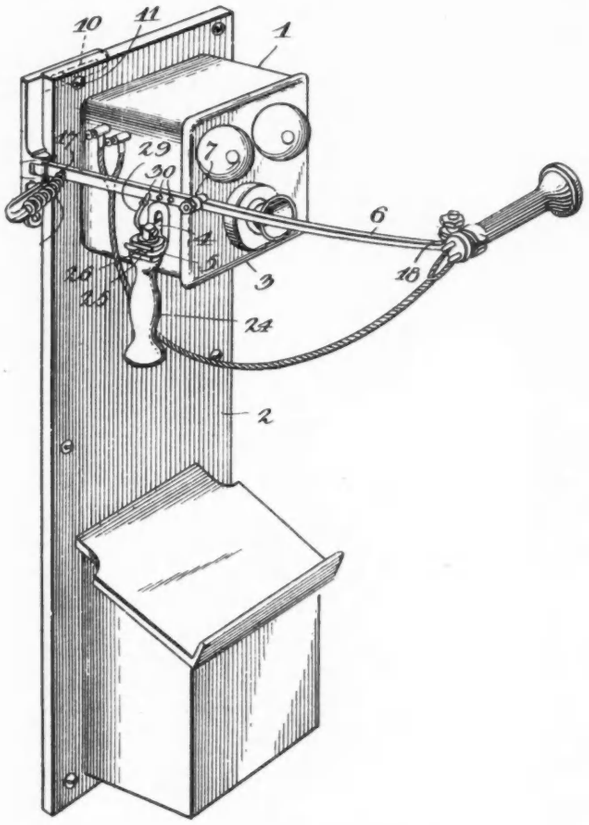
are arranged on the diaphragm in such manner that the current enters through one electrode chamber and passes successively through all in series, thus giving a cumulative effect when the diaphragm vibrates. The figure given illustrates this diagrammatically, L L being a line connected to a battery, B, at the central office, and a receiver, R, D^1 D^2 being the resistance varying elements, and P^1 P^2 P^3, the contacts on the diaphragm D.

No. 664,941.—G. W. Hanoe. Telephone Attachment.

This is a receiver support for wall sets, consisting of a lever arm, 6, pivoted to the backboard so as to have lateral motion, and normally held in against the side of the transmitter support by a strong spring, the receiver then projecting across the front of the transmitter. A weight, 24, is hung upon the switch hook to normally hold it down, being connected by a cord, 29, with the lever, 6. When the instrument is to be used the lever, 6, is moved to the left to bring the receiver into proper position at the ear, and the cord, 29, then lifts the weight to make the necessary circuit changes.

No. 665,134.—E. E. Salisbury. Telegraph or Telephone Call Mechanism.

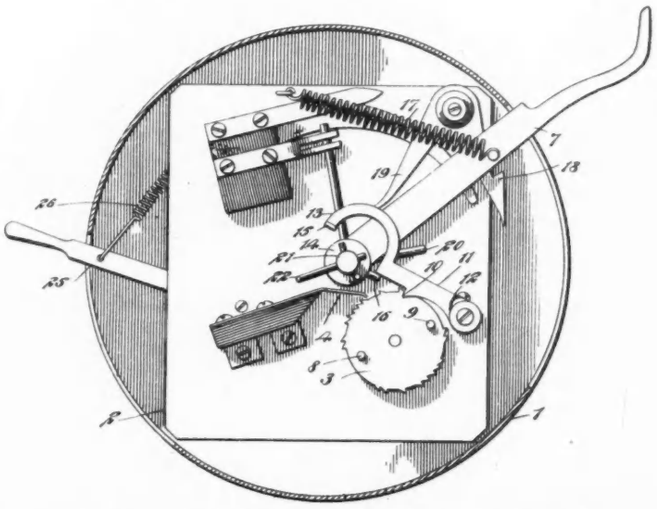
This is a messenger call box or "District Messenger Box," arranged to be operated either by the ordinary pull lever, or by a telephone hook lever. The usual break wheel, 3, and contact pen, 4, are provided with clock-work mechanism, rotating the wheel when released. The mechanism is normally held by one of the pins, 8-9, resting against a detent, 10, on the lever, 11, and when the receiver is moved from the hook, 7, the latter rises under the influence of the spring, 17, the pin, 16, then raising the lever, 11, and re-



664,941—TELEPHONE ATTACHMENT.

leasing the break wheel. At the same time a pin on the hook lever passes over a hook, 18, on a bell-crank lever, 19, to prevent the hook lever from again dropping down until the signal has been completed. When the latter is finished, the pin, 20, being turned by the central arbor, 21, strikes the arm, 19, and releases the hook lever.

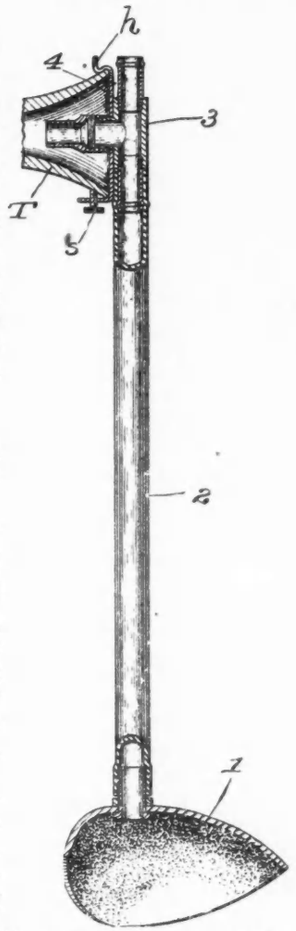
In case it is desired to send in a call without using the telephone, the hand lever, 25, is employed, which winds up the mechanism by means of a pawl and ratchet wheel.



665,134—TELEGRAPH OR TELEPHONE CALL MECHANISM.

No. 665,251.—W. S. Moore. Mouthpiece for Telephone Transmitter.

This is a device intended to be clamped across any ordinary mouthpiece, for secret conversation. It consists essentially of a metal tube, 3, clamped across the mouthpiece, T, by clamps, h, and a rubber tube. 2, having a rubber shield, 1, at its lower end, to be placed over the nose and mouth. From the tube, 3, a right-angled extension projects within the mouthpiece, T, the front of the mouthpiece not being closed thereby, but remaining open on each side of the tube, 3.



665,251—MOUTHPIECE FOR TELEPHONE TRANSMITTER.

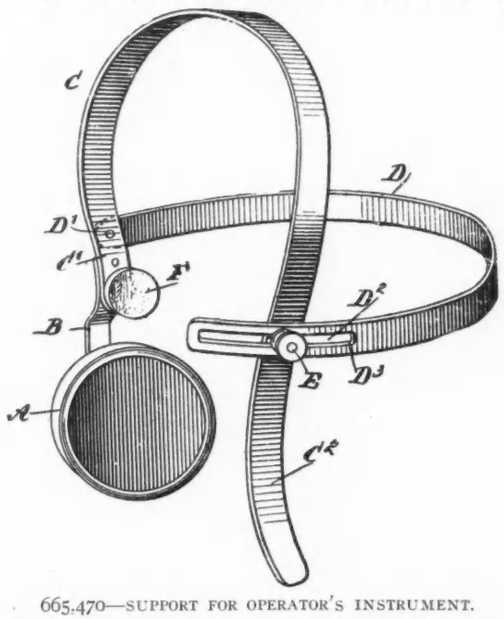
JANUARY 8.

No. 665,470.—G. A. Rutherford. Support for Operators' Instruments.

This is a head-band support, having the members, C and D, arranged substantially at right angles to each other, the former having curved extensions, C^1 C^2, and a button, F, which rests upon the side of the head to keep the receiver, A, in proper position with regard to the ear.

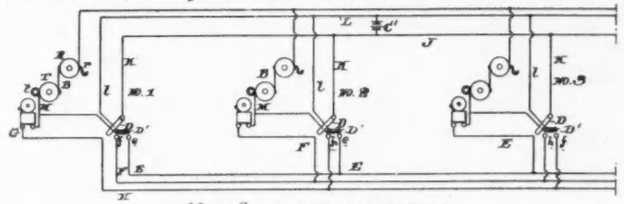
No. 665,548.—L. W. Pullen. Telephonic System.

This is an intercommunicating system, having as its principal feature, a short circuit around the receiver and transmitter, when the former is hung upon its hook. Supposing all of the receivers to be thus hung up, if station No. 1 desired to call No. 3, the switch, D, would be turned to the contact, e, and pressed down. Current would then flow from common battery, C^1, through wire, L, and branch, 1, to the contacts, D^1, which are crossed together



665,470—SUPPORT FOR OPERATOR'S INSTRUMENT.

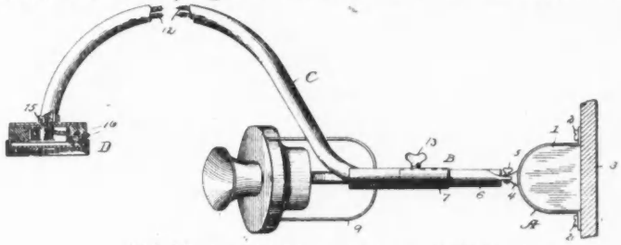
when the switch-arm is depressed, although insulated from the arm proper, thence to wire, M, to ring, t, and hook, r, to wire, A, to station 3, there through the branch wire to bell, passing around the transmitter and receiver as before, and through wire, e, to the individual line wire of station 3, to contact, e, at station No. 1. When the call is answered, the parties at both stations take down their


665,548—TELEPHONE SYSTEM.

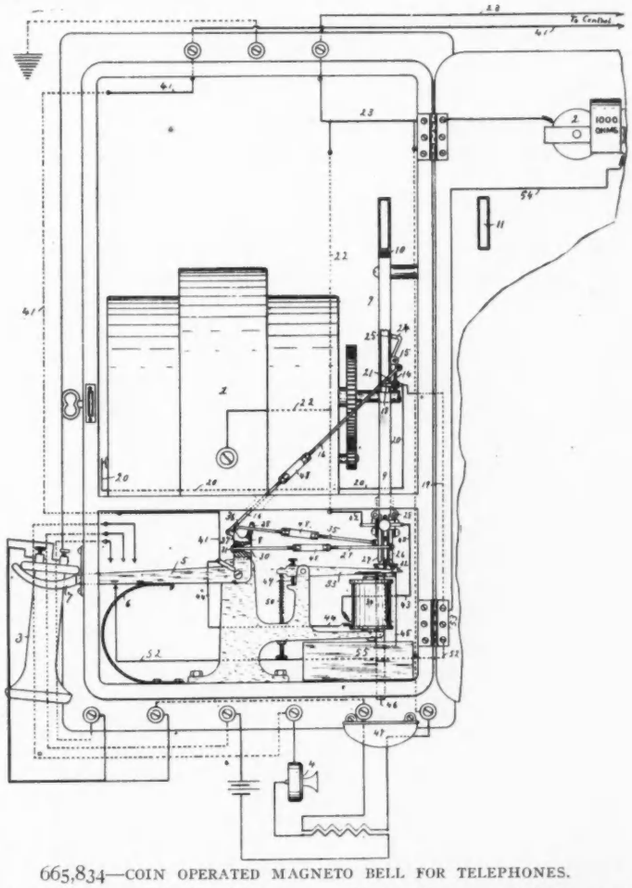
receivers, and talk through the two ringers, G, which "are of low resistance."

No. 665,788.—D. Laing and G. M. Ferry. Attachment for Telephones.

This is a tubular support for a receiver, D, curved about and overlying the transmitter and its supporting


665,788—ATTACHMENT FOR TELEPHONES.

arm. The support is pivoted to a saddle, A, intended to be attached to the coil box of the transmitter. A curved metal plate, 9, is attached to the transmitter arm and supports the arm, C.


665,834—COIN OPERATED MAGNETO BELL FOR TELEPHONES.

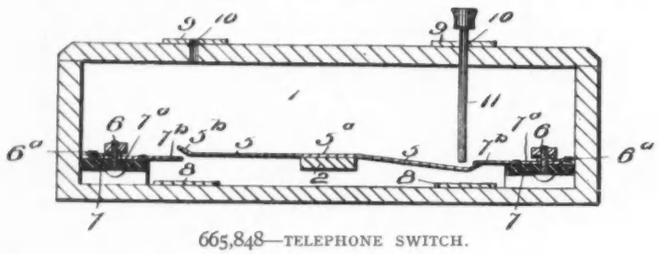
No. 665,834.—H. R. Mason. Coin Operated Magneto Bell for Telephones.

In this device it is necessary to insert a coin through

the slot, 11, in the door of the magneto box, into the chute, 10, before a call can be made. The coin falls through the chute until it rests on a pair of pins (of which only one, 18, is shown) and by bridging across these pins closes the generator circuit. The call having been sent, the receiver, 3, is removed from the hook, 7, which rises, and in its motion acts through a connecting rod, 16, to push the pin, 17-18, out of the path of the coin, which thereupon drops down to the lower end of the chute, where it stands between plates, 26-27, over a partition in the middle of a double chute, 45-46, one of whose channels, 45, leads to the till, 55, and the other, 46, leads out to a coin receptacle, 47, outside of the magneto box. The plate, 26, has a latch, 32, on a lever, 33, controlled by the magnet, 34, which is bridged across the generator terminals when the coin crosses the contacts between plates, 26-27. Consequently, if the connection desired is obtained, the operator throws a suitable current to line, to energize magnet, 34, thereby releasing the plate, 26, and permitting the coin to fall through the channel, 45, into the till, whereas, if the connection desired cannot be obtained, the magnet is not energized, and the hook through a tooth, 37, and pawl, 36, on connecting rod, 35, moves plate, 27, to permit the coin to fall through the channel, 46, into the receptacle, 47.

No. 665,848.—N. Bassett. Telephone Switch.

This is a switch for intercommunicating systems, having a central part, 5a, with laterally extending fingers over-



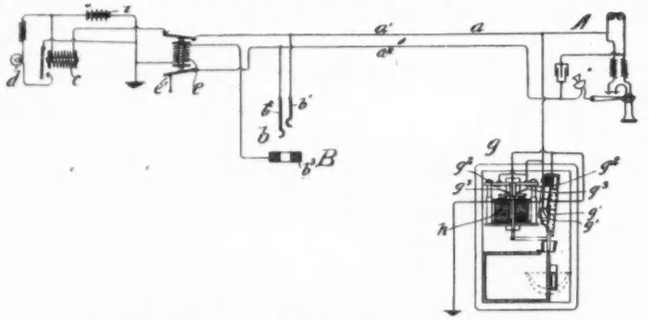
665,848—TELEPHONE SWITCH.

lying the line terminals, 7a. The central portion forms a bus connection for the local circuits of the instruments, and in order to connect the same with any other station, a pin (not shown) is inserted through the front of the box to push any desired one of the flexible springs, 5, pass the desired contact, 7b, where it remains detained until the hook, 3, is moved down by hanging up the receiver. All of the springs, 5, are then slid down out of line with the terminals, and any that have been pushed in will spring out to their normal position.

JANUARY 15.

No. 665,874.—A. M. Bullard. Apparatus for Telephone Toll Line.

This is a toll collecting device for telephone pay stations, wherein the call is made automatically by depositing

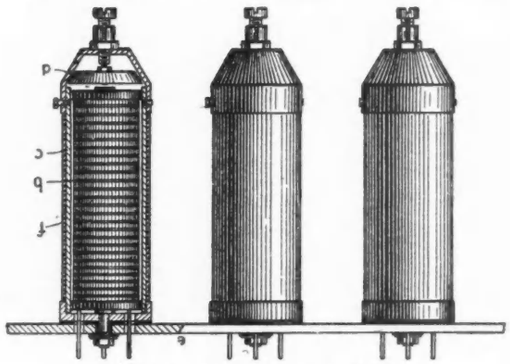


665,874—APPARATUS FOR TELEPHONE TOLL LINE.

the coin, the latter being returned if the desired connection cannot be obtained. The circuits shown are those ordinarily employed with the well-known relay type of bell switchboards, operating on a common battery; c is the line relay, grounded through battery, i, e is the cut-off relay with the usual ground at e^1 omitted. It is necessary to put on a ground at the subscriber's station call, but this ground is normally disconnected at the contacts, g^1, in the toll box. When a coin is dropped, it passes into a chute and at the lower end thereof strikes one arm of a lever the other end of which forces together the contacts, g^1, this making the call. Beneath the lower end of the chute is a pivoted dog, connected to and adapted to be moved one way or the other by the armature of a polarized magnet, h. The operator at central is furnished with two keys, one of which throws plus current at 110 volts on the line, and the other minus current. This high voltage is necessary in order that the calling battery, i, may not energize magnet, h, the latter being high wound. If the desired connection is obtained the operator depresses one button to throw the pivoted dog into position to the right so that the coin may drop into the toll box; if it cannot be obtained she presses the other button to move the dog in a reversed direction, when the coin will pass out of the box and be returned to the party calling.

No. 665,923.—F. R. McBerty. Telephone Appliance.

This invention concerns electro-magnets with closed magnetic circuits, for use in circuits carrying telephonic



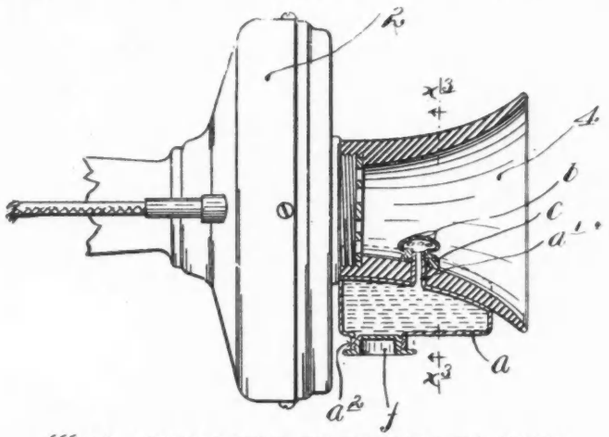
665,923—TELEPHONE APPLIANCE.

or other rapidly changing currents, the object being to prevent the inductive propagation of corresponding currents in neighboring circuits or magnets. It is particularly intended to be used with signal magnets or repeating coils in telephonic circuits, since these are commonly placed close together in groups, and the circuits must be free from cross-talk. When electro-magnets interposed directly in telephonic circuits or located in bridges of such circuits are placed near together, it is found that although the magnetic or iron circuit of the magnet may be closed through a mass of iron of large cross-section, there is still a considerable amount of magnetic leakage from the extremities of the circuit or stray lines of force. These lines of force seek a return through the magnetic circuits of neighboring magnets, and thus tend to induce disturbing currents in the circuits surrounding the cores of neighboring magnets. This is true, not only of electro-magnets, with movable armatures, but of impedance coils and induction coils, whether of the open-circuit or closed-circuit type. The present invention aims to prevent the creation of stray lines of force by the undulating or alternating telephonic current, and to this end consists in surrounding the closed magnetic circuit of the electro-magnetic appliance with a closed conducting-circuit of low resistance, such as a thick tube of copper or other metal, or in otherwise so disposing in the vicinity of the appliance a mass of conducting material in position to be threaded by the stray lines of force. The function of this mass or tube of conducting material is to prevent the propagation of these lines of force into adjacent magnet cores or circuits by permitting them to expend their energy in inducing currents in the conducting mass. For instance, in the case of a closed-

circuit electro-magnet surrounded by a copper tube, the lines of force which circulate within the closed magnetic circuit are not affected or disturbed by the copper tube, and thus serve with undiminished efficiency to perform any work required; but the stray lines of force emanating from projecting or prominent portions of the magnetic circuit and tending to return through the air or adjacent masses of magnetic material thread the encircling copper tube but once, and therefore induce currents in the copper tube which tend to suppress the rapidly alternating or undulating induction. Thus, in the case of two adjacent electromagnets in telephonic circuits, which are ordinarily characterized by strong cross-talk through their mutual induction, the cross-talk may be perfectly suppressed and eliminated by surrounding either, or preferably both, of the closed magnetic circuits with thick tubes of conducting material, according to this inventor. In the figure the signal magnet is shown surrounded by an iron jacket split its entire length, this jacket serving to complete the magnetic circuit to the armature, d. Outside of the iron jacket is a closed copper jacket, f. This same method is followed with the repeating coils, the entire coil and magnetic circuit being surrounded by the copper.

No. 666,199.—A. B. Larsen. Germicide Device for Telephone Transmitters.

This invention consists of a small tank or reservoir having a closure, f, and a nipple, a^1, extending up into the

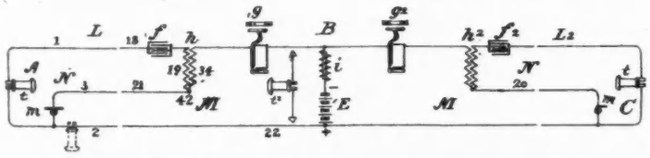


666,199—GERMICIDE DEVICE FOR TELEPHONE TRANSMITTER.

mouthpiece, 4, of a transmitter, 2. The upper end of the nipple is provided with a nozzle, b, through which the solution in the reservoir, a, gradually evaporates, thus keeping the interior of the mouthpiece constantly disinfected.

No. 666,213.—G. K. Thompson. Telephone Exchange Circuit and Appliance.

This invention is really a system to be used in connection with the relay board of the Bell Telephone Com-



666,213—TELEPHONE EXCHANGE CIRCUITS AND APPLIANCE.

pany, using common battery at the central office for all purposes. In such systems an induction coil has frequently been used at the subscriber's station, a condenser being necessary in such case, the current from central flowing through one-half of the coil and the transmitter, the induced currents being sent through the receiver and condenser to line. It is the desire of the inventor to remove both the condenser and coil from the subscriber's station. In order not to derange his circuits, but to maintain the same conditions throughout the system, he uses three-line wires, instead of two. In other words, it is a three-wire system, with the local subscribers' circuits prolonged by means of the three-wire to the central office. In the diagram, the circuits are shown continuous, A and C being two subscribers' stations, connected through the usual cords and plugs at the central office, D. E is the bridged battery, g and g^2 are the usual supervisory signals included in the cord. The induction coil, 19-34, and condenser, f, are also included in the cord circuit, the breaks in the lines indicating the points of contact of the plugs and jacks. As a matter of fact, this arrangement greatly reduces the number of condensers and coils, but most people will find it difficult to see any advantage in a system involving the use of three wires for each subscriber.

KANSAS INDEPENDENT TELEPHONE ASSOCIATION FORMED.

The Kansas Independent Telephone Association was organized at a meeting held in Salina, Kan., on January 10, 1901. One of the main objects of the meeting was the adoption of a uniform toll-line rate of 25 cents for a distance of not over 40 miles on any line and 10 cents for each additional 40 miles or fraction thereof.

The following officers were elected for the ensuing year:

President, S. C. Crummer, Bellville; vice-president, C. A. Murdock, Clifton; secretary, D. W. Dorty, Concordia; treasurer, Dr. Armstrong, Greenleaf.

Those in attendance were: S. C. Crummer, Belleville; A. R. Champlin, Newton; Alvin Lung, Lyons; C. S. Brown, Abilene; C. D. Wells, Marion; J. H. McMahan, Alma; C. F. Pohlman, Ellsworth; S. J. Blair, Topeka; W. D. DeVarney, Kansas City; C. W. Trice, Clay Center; W. H. Nelson, Smith Center; H. H. Willy, W. H. Hall, Downs; Anson Miller, Council Grove; H. H. Yager; Thomas Dolan, Clifton; H. N. Farris, Washington; John Anderson, Lindsborg H. P. Wharham, Manhattan; J. E. Wright, McPherson; J. A. Sohlinger, Clyde; W. W. Reese, Emporia; W. W. Delworth, Beloit; R. L. Gilpin; F. H. Dougherity, Concordia; H. L. Pierce, Belleville and L. J. Reese, Lincoln.

MISSOURI TELEPHONE CONVENTION HELD.

The Missouri River Telephone Association was organized at St. Joseph, Mo., on January 10, 1901. About twenty exchanges and toll lines in Northwest Missouri, Southern Iowa and Eastern Kansas are members. The officers are H. E. Ralston, Maryville, Mo., president; G. A. Haynie, Savannah, Mo., vice-president; L. N. Fry, Granite City, Mo., secretary and treasurer. These, with F. S. Travis of Tarkio and J. T. Norman of Stanberry, constitute the executive committee. The object of the association is to establish uniform rules governing exchanges and for mutual protection. Those who attended the meeting were F. R. Allen, of Gower, Seward Telephone Company; G. A. Haynie, Savannah, L. N. Fry, Grant City, Conway Telephone Company; B. F. Babson, Bedford, Iowa, Conway Telephone Company; E. C. Wolfers, Maryville, Hannamo Telephone Company; H. E. Ralson, Maryville, Hannamo Toll Line Company; E. H. Berry, Platte Purchase Telephone Company; W. F. Rankin, Tarkio, Northwest Missouri Telephone Company; F. S. Travis, Tarkio, Northwestern Missouri Telephone Company; R. S. Liggett, Stanberry, Stanberry Telephone Company; D. M. Martin, Oregon, Oregon and Forest City Telephone Company; E. C. Bowlin, Plattsburg, Plattsburg Telephone Company; J. T. Norman, Stanberry, Gentry County Telephone Company; J. C. Smith, McFall, Grand River Telephone Company; A. J. Fuller, Bethany, Harrison County Telephone Company; J. T. Lile, Evona, Mo., Grand River Telephone Company.

TELEPHONY, HERE AND ELSEWHERE.

BY HERBERT LAWS WEBB. (CONCLUDED.)

Along the railway cuttings there are pole lines for the telegraph, and those pole lines are curiosities that have to be seen to be appreciated; no description can do them justice. Fortunately for the Paris telephone system the world-famous network of sewers that underlies the streets of the city of light was there, like a ready-made subway system, to receive the cables when it became necessary to lay telephone cables. The Paris main sewers are egg-shaped tunnels, in which you can walk. There are pleasanter places to walk in, and, in fact, I have never walked in a more unpleasant place, but still you can walk long distances under the streets of Paris in the sewers. Where there is space to walk there is space for cables, so the telephone cables are all in the sewers, and connection is made to the subscriber's premises through the sewer walls into the cellars of the houses. Another peculiarity of the Paris, or rather of the French, system is that the subscriber has to furnish his own station apparatus. To make the choice easy for him there are about five hundred different types of telephone sets, approved by the administration, from which he may select the instrument that he buys.

Turning, as one naturally does in these days of Napoleonic revival, from France to Austria, we find that in the one country, as in the other, telephony is practically confined to a few large cities. The business was originally carried on by English companies, which have gradually been bought out by the government, which acquired the last of the company systems—that of Vienna—about five years ago. The Vienna system has been completely reconstructed by the administration, the new plant including two magnificent central office buildings with modern switchboard equipment and a distributing system of cement conduits with paper cables. Apart from Vienna, which is not developed telephonically nearly in proportion to its population, having less than half as many telephones as Paris and about one-third as many as Berlin, there are no large systems in Austria. Trieste and Prague have telephone systems not much larger than those of small towns in this country. Budapest, the sister capital of the Austro-Hungarian empire, has a telephone system, but it is in a very backward state of development, and has not kept pace with the other modern improvements of the famous Hungarian metropolis. To telephone men Budapest is chiefly interesting as the home of that curious institution, the telephone newspaper. I, for one, had always been rather skeptical about the telephone newspaper, but it is there, is a going concern, has over 7,000 subscribers and pays dividends. The subscriber's equipment is simply a pair of watch-case receivers, attached to a tiny backboard. At any hour of the day or night, from 9 a. m. to midnight, you can get something from the outside world through your connection with the telephone newspaper. Simply by picking up the two receivers you listen in the morning to a stream of stock quotations and general news; at noontime to stories for children; in the afternoon, financial news from all the exchanges of Europe, and local and foreign news of the day; in the early evening, music from the orchestra of the coffee-houses, and later on, music from the regular theaters and from the opera. There is a printed program, showing exactly what kind of news or entertainment may be expected at any hour of the day, and the whole thing is very well organized and is evidently popular with the Budapesters. A somewhat similar enterprise exists both in London and Paris, but limited to connection with the theaters, churches and other public institutions. The service in London and Paris is supplied, not over a separate system, as in Budapest, but over the regular telephone wires, the subscribers paying an extra rate for the privilege of having music or sermons brought by telephone to their own firesides.

East of Hungary, the telephone has not flourished. Bucharest has a system of a few hundred subscribers, Constantinople has no system at all, electricity in any form being barred from the sultan's dominions. In Russia telephone development has been very slow and is confined to the few large cities; the enterprise has been under company management, but new concessions for St. Petersburg and Moscow have recently been put up to competition, and, I believe, secured by the municipalities. All this, however, is but hearsay information, as my own travels in Europe have not yet led me east of the Danube.

It is in the smaller countries of Europe that telephonic development has been most active, and the policy most enlightened, the management in some cases closely approaching American lines. Belgium and Holland can scarcely be cited as examples of this, but Sweden and Norway can, and so also, to a certain extent, can Switzerland. Company management started the ball rolling in all these countries, but the pioneer companies have been frozen out practically everywhere but in Sweden; in Switzerland and Belgium by the governments, in Holland by the municipalities, and in Norway also by the municipality of Christiana. What a subject for the convention of pioneers would be the story of the taking over of the telephone service of Amsterdam and Rotterdam by the municipalities of those cities. As a matter of fact, the city fathers of Amsterdam took over nothing at all. Failing to come to terms with the company, as the concession was about to expire, with true, sturdy Dutch independence, they set to work to build a complete new telephone system, had it in working order by the required date, and then compelled the company to remove its entire plant! Amsterdam and Rotterdam are both populous and busy cities; telephonically they have not yet been developed nearly up to the point at which American ideas of city telephone systems to-day aim; it will be interesting to see what progress municipal management makes with the telephone. In Christiana it has been successful, as Christiana has a large telephone system and an excellent service, but this has been built up under company management with municipal control, rather than under municipal management pure and simple.

For the honor and glory of company management, let it be said that absolutely the most progressive and enlightened telephone administration in Europe is that of the Stockholm General Telephone Company. Consequently Stockholm is the best telephoned city in Europe, and indeed runs some American cities pretty close; has the best-equipped telephone system (the equipment is largely copied from American apparatus), and has the best telephone service. The history of the Stockholm company would take up a whole day's meeting of the convention of pioneers and cannot be given here, except in barest outline. It was organized to fight the pioneer company, fought it to a standstill and absorbed it; then branched out after long-distance lines and brought the State Telegraph Department into the fray, which is still going on. The State Telegraph Department defeated the company's proposed long-distance extension of its business and started an opposition system in Stockholm, waging an active rate war on the company. The company has a long lead on the government system, however; it is alertly and aggressively managed, splendidly advertised, kept abreast of all technical improvements in the art, financed by methods that might give pointers to Wall street, and operated by a staff that would do credit to any American exchange. Altogether, Stockholm is quite a fasci-

nating place for the telephone man to visit, apart from its natural charms, which are many.

After Stockholm it is scarcely worth while to touch on other European telephone centers, though a few may have been ignored, perhaps not unkindly, so let us look at what is doing at home. In the United States there has set in during the past few years a wave of development in telephony that bids fair to carry the telephone to a degree of popularity that was undreamed of by even the most sanguine management six or seven years ago. To define completely all the causes that have contributed to this sudden increase in the use of the telephone would probably be difficult for me, and most certainly tiresome for you. But to put it briefly, it may be said that in the past five years the telephone in America has "found itself." The period of fifteen years or so previous to 1895-96 was a period of experiment; experiments with switchboards, with wires and cables, with instruments, with apparatus of every sort, with buildings, with methods of construction and systems of distribution, with methods of operating and with operators, with systems of rates, and with the public. During this period the progress in the art was so rapid that nobody could say how long a given type of switchboard, say, or of cable, would be the proper thing to use. The plant was always in a state of upheaval and reconstruction, and it was impossible to tell how much the service cost and how much it could be sold for for a year at a time. Conditions have lately become more stable. Finality in telephone construction has not been reached any more than it has in shipbuilding, but it is possible now to look a great deal farther ahead than it was ten years ago, to calculate better what the service can be furnished for, to give a thoroughly efficient service, and to evolve scientific rate schemes that will attract public patronage. Then it has been found that it pays to advertise telephone service, to canvass for customers and to generally treat the sale of telephone service much as the endeavor to sell to the general public is treated in any other line of business. In short, the telephone has found itself, and the American public is finding out the telephone in daily increasing numbers.

Nobody can have followed me in my discursive ramble through European telephone affairs without reflecting how singularly free from the repressive influences that have clogged the wheels of telephonic progress in Europe American telephony has been. With no government monopoly of telegraphs, and the craze for municipal control of industries still in its infancy, there has been absolutely no interference with the free development of the telephone along its own lines. Had there been a federal monopoly of telegraphs and had the telephone come early under its control, as has happened in almost all European countries, the United States would not to-day have more telephones in service than there are in the whole of Europe. The inertia of a great government department accords ill with the progressive methods and active management required for the development of the telephone. In Europe the telephone has largely fallen under the control of old telegraph men, who, wedded to their first love, look on the telephone as the ugly sister of the telegraph, a necessary evil, but to be kept in a back seat, served with the inferior cuts and dressed in the cheapest of apparel. In America a race of telephone men have grown up with the telephone, and the telephone, far from being looked on as a poor relation of the telegraph, is as a bright young Benjamin, able to carve his own way in the world and to make a career for himself that bids fair to eclipse the fame and importance of his elders.

"Allow me to compliment you on the appearance of your paper. It is very good, and from what I hear has produced an excellent impression.

C. H. WARREN,
Cleveland, Ohio."

OCEAN TELEPHONY PROBLEM SOLVED.

Ever since the perfection of the telephone the possibility of utilizing the principle embodied in it for "talking across the ocean" has engaged the thought and experimentation of many electricians. It was obvious that the invention of a practicable ocean telephone which would transmit vocal messages under water as easily as they are transmitted by land lines would be of immeasurable value to the commercial world.

A successful device for ocean telephony seems at last to have been perfected by Professor Michael I. Pupin, professor of electrical engineering at Columbia College. If the invention turns out to be all that is claimed for it, it will easily lead the list of great twentieth century inventions.

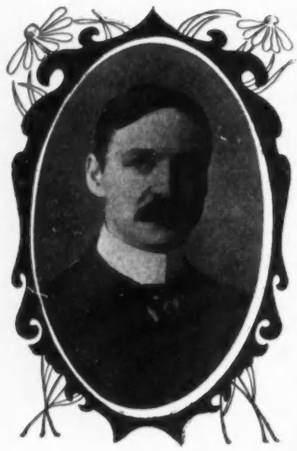
PROF. MICHAEL I. PUPIN.

The best evidence that Professor Pupin's ocean telephone has stood the tests that are necessary to demonstrate its scientific practicability is supplied in the purchase of the invention by the Bell Telephone Company for a half million dollars, and the giving to the inventor of a royalty of $15,000 a year during the life of the patents. The public will not be disposed to ask for any better proof of the practicability of the device than this, although the results of the inauguration of the first ocean telephone system in the world between Florida and Cuba will be awaited with interest.

A well-known telephone engineer is preparing an article on Professor Pupin's invention, which will be published in the March TELEPHONY.

INSTALLATION OF TELEPHONE EXCHANGE CIRCUITS.

BY H. C. DODGE AND C. C. CADDEN.



In this article we advocate a simple method of installation of telephone circuits in which is comprehended little if anything that is new, but as it is of great importance that this work be systematically done, the following suggestions, suppositions and recommendations, which are based upon easily remembered rules, we trust, will prove of value to novices in the independent field. The matters considered are gone into only in a superficial way, and if dwelled upon in all their ramifications, would require a great amount of explanation.

In tracing the lines, we will begin with the switchboard, one of metallic circuit type, which consequently is adapted for use in connection with grounded, common return wire and metallic circuits, or a combination of the three. It is desirable that the board and office cables be carried out to terminals for connection of full metallic circuits, as this arrangement facilitates the making of any desired changes of incoming circuits at the terminals without disturbing any of the wiring from this point, to and including the switchboard. The cables being full metallic and in twisted pairs; the supposition being that cables are

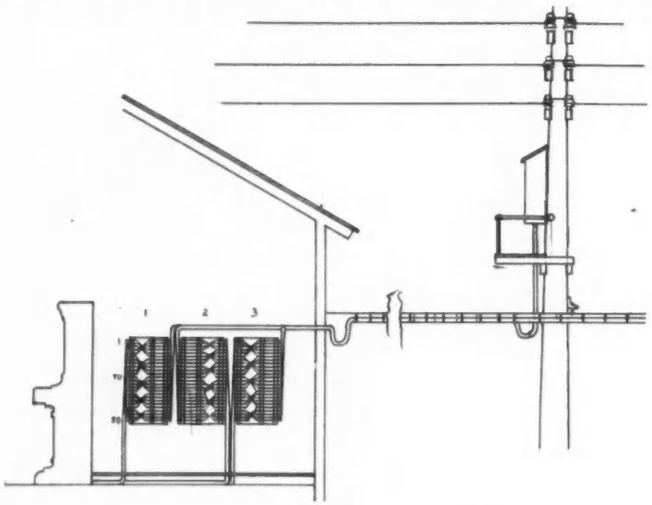


FIG. 1.

good ones, free from leakage, the board being free from inherent defects allowing of cross-talk and induction disturbances; troubles of this nature (providing, of course, the arresters, distributing boards and terminals, are of the approved standard of insulation and construction, the circuits being perfectly balanced) will be eliminated up to the point mentioned and troublesome cross-talk and induction may be looked for, and will exist only on the line side of these terminals. The additional cost of metallic circuit cables, etc., as compared with the old method of carrying single lines from the switchboard to cable terminals, is not to be considered in view of the improvement in the service and ease afforded in matter of making changes; for instance, from a common return system of wiring to complete metallic circuits, as will be appreciated. The insulation of each pair of conductors of cables should be of different color—say, one of red and one of white, and should be connected to terminals in regular order. The red wires, representing, if you please, the odd numbers, 1, 3, 5, 7, etc., and the even numbers, 2, 4, 6, 8, etc., the latter being the white covered wires; this being done the red wire being electrically connected with tip of the plug, (when same is inserted in the spring-jack) and the white with the sleeve thereof, liability of a "mix-up," which will occur in the grounded or common return wire system, owing to connection of line wire to the sleeve side,

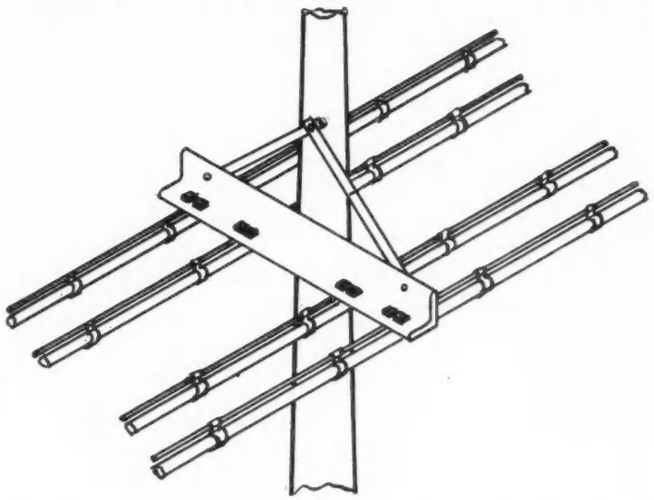


FIG. 2.

where it should be connected to the tip side is prevented. The cables from the switchboard treminals are led to the cross connecting board. Figure 1 shows a very serviceable form of cross-connecting board; in this are shown cables taken out at the bottom of the switchboard, and passing under a false floor to the cross-connecting boards. Two cables of 50 pairs each are shown, cable No. 1 being connected to drops from 1 to 50 inclusive; No. 2 from 51 to 100 inclusive. The terminals of No. 1 are connected to clips on the first cross-connecting board, these clips corresponding with switchboard terminal numbers, cable No. 2 being connected to the second cross-connecting board. The clips are numbered in pairs from 1

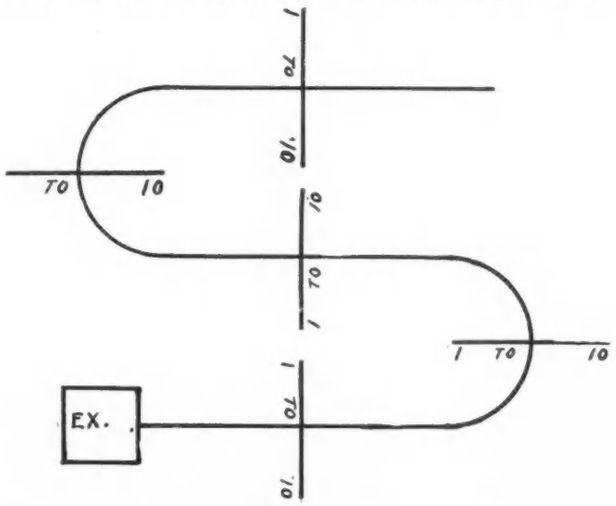


FIG. 3.

to 50. Directly connected to the clips of the line side of the cross-connecting boards ,are the lightning arresters and fuses; to connect the different pairs of clips on the switchboard side to the proper pair of clips on the line side jumper wires, made in twisted pairs, are used, thus, it will be seen that telephone No. 2 may be connected to pair No. 30 in line cable No. 2—a pair of jumper wires being connected with the pair of clips No. 30 on cross-connecting board No. 2, and are led over in an orderly

manner by means of pegs or screw-eyes, provided on the board, to the pair of clips No. 2 on the switchboard side of same. The line cables are led from the cross-connecting boards to the office pole; these are strung on messenger wires, which are fastened to a cross-arm preferably made of a piece of angle iron, as shown in Fig. 2.

Remember the system of wiring, here represented, is based upon the three following easily remembered rules, i. e.: First, all numbering horizontally is read from left to right. Second, all numbering vertically is read from top downward. Third, rules No. 1 and No. 2 apply in all leads and read as you look away from the exchange. Diagram No. 3 will elucidate the rules more fully. Fig. No. 4 shows a pole with three cross-arms; the pins are numbered from left to right, the reader being between the pole and the exchange; hence, line No. 20 is on pins 29 and 30. For leads in the business section of the town,

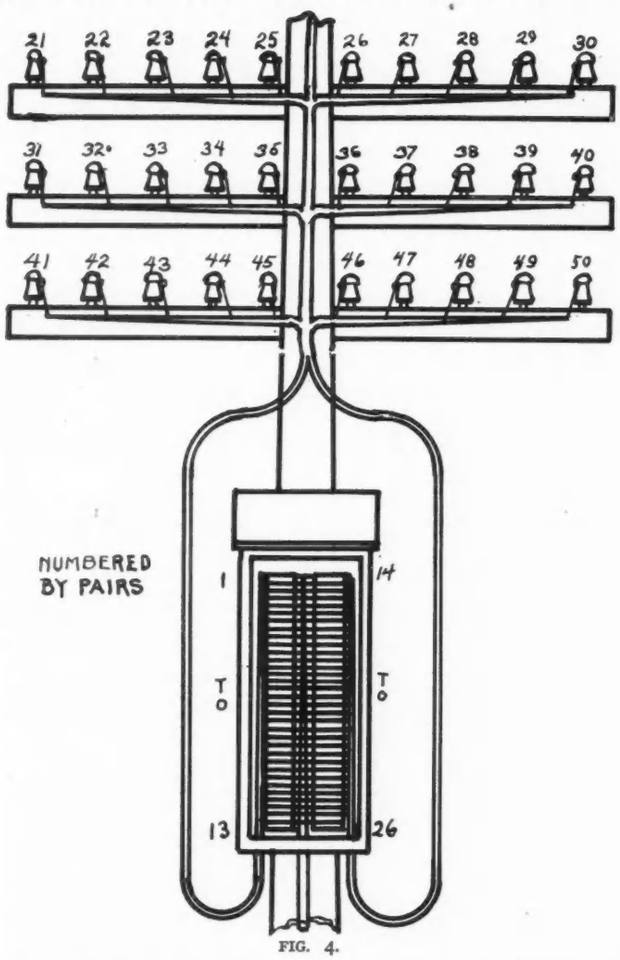


FIG. 4.

it is generally not advisable to use more than five ten-pin cross-arms on a pole, and the leads are as they are laid out in Fig. 5. Cable pole No. A1 has two sets of cross-arms, as shown in Fig. 1; these arms are provided with transposition insulators; the incoming line wires are strung to the lower grooves and dead-ended there, thus opening the lines at this point and dividing the lead into two sections. The insulators opposite each other are very securely bound together in pairs by wires in the top groove. With five ten-pin cross-arms to the pole, there will be 25 pairs to the section, and as 50-pair cables are as large as it is convenient to handle, there will be one cable to two sections in the business part of the town, where the sections will be short on account of the close proximity of the subscribers. It will usually be found less expensive to run a 50-pair cable to a cable pole, and pay out to the 50 pair of wires which terminate there, 25 pairs in a section, as shown in arrangement in office pole in Fig. 5. When the longer leads are reached in the residence districts, where the subscribers are more scattered, it will be cheaper to run a 50-pair cable to the end of the nearest section to the exchange, that it feeds out to, and put in a tee, and from the tee to the cable box run a 25-pair lead-encased rubber insulated cable, and for the remaining cir-

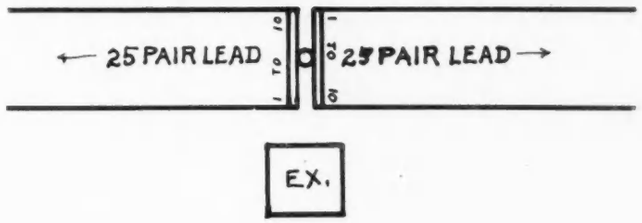


FIG. 5.

cuits, splice a 25-pair cable and carry it to the second section, which this cable feeds to. In remoter outlying districts, open aerial construction should be used entirely. In Fig. 5, the method of connecting the cable and fuse head is shown. (One 25-pair fuse head is shown). The pairs number from the top downward on the fuse board. The spider wires for the line side of the fuse head are led to their respective pins on the cross arms, and are to be neatly, but loosely, laced into the cable.

DUPLEX TELEPHONE LINE IN JAPAN.

Some time ago the Japanese government caused to be installed two metallic-circuit telephone toll lines between Yokohama and Tokio, a distance of about 15 miles. The traffic soon exceeded the capacity of these lines, and in default of a government appropriation for a third line, it was decided to duplex the two existing ones. To do this the repeating coil at each end of either circuit (four in all) was split at the middle point of its primary winding, and a wire placed connecting these two points in the two coils at Yokohama, and a similar connection between the two coils at Tokio. In each of these cross-connecting circuits was placed the ordinary microphone and telephone apparatus. Thus a third circuit was obtained, the two legs of which were double, each leg embracing the two parallel wires of one existing metallic circuit. Interference and cross-talk between the new instruments and the others was thus neutralized in each circuit. The duplex arrangement has been working satisfactorily since its installation. An engineer of the Erie Telephone Company worked out the details of the arrangement.

TRAIN TELEGRAPHY AND TELEPHONY IN JAPAN.

The utilization of both the telegraph and telephone on the state railways of Japan has been quite rapid, and the development in this respect is equal to that occurring in the regular commercial service. The last annual report, received recently, has an interesting diagram of the different lines showing the various stations on the lines of the Imperial Government Railways, and enumerates the telegraph, telephone and block signal systems in detail. Altogether the 95 points on the railway were equipped, it would appear, as follows: Five had telegraph instruments only; 38 had telegraph and block signaling apparatus; 1 had block signaling only; 10 had telegraph, telephone and block signaling apparatus. Four of the stations were equipped only with telephones. One feature to note is that at 54 of the stations the government accepted telegrams for transmission from the public. The total telegraphic traffic for the last year reported was 2,773,796 messages, of which 412,594 were from the public, the others being on service. It would appear that the total length of line of the Imperial Railways open up to March, 1899, was 718 miles; or 1,010 miles of single track, the gauge of which is stated to be 3 ft. 6 ins.

CONVENTION OF THE INTERSTATE TELEPHONE ASSOCIATION.

The fourth semi-annual meeting of the Interstate Telephone Association was held January 15, 1901, at the Hotel Baltimore, in Kansas City, Mo. The following persons were present:

J. H. Goodwin, president California and Bunceton Telephone Exchange of Bunceton, Mo.; Ed. T. Purcell, manager Saline County Telephone Company, Marceline, Mo.;

FRED. R. BA SOM, PRESIDENT INTERSTATE TELEPHONE ASSOCIATION.

F. W. Daugherty, Concordia, Kan.; Shem Zook, Quick Telephone Company, Harrisonville, Mo.; A. R. Champlin, Newton Telephone Company, Newton, Kan.; George W. Schweer, Missouri Union Telephone Company, Windsor, Mo.; William F. Sikes, Wellington Telephone Exchange, Wellington, Kan.; Fred. R. BaSom, Joplin Telephone Company, Joplin, Mo.; Hickman & Perkins Telephone Company, Independence, Kan.; J. O. Woods, Seneca Telephone Company, Seneca, Mo.; C. H. Wallis, Central Electric Telephone Company, St. Louis, Mo.; H. Hodges, Paola Telephone Company, Paola, Kan.; E. F. Walker, manager Nevada Telephone Company, Nevada, Mo.; U. S. Hannan, Iola, Kan.; U. G. Honnell, Citizens' Telephone Company, Excelsior Springs, Mo.; C. S. Penwell, Eureka Telephone Exchange, Eureka, Kan.; J. E. Taylor, B. R. Electric Company, Kansas City, Mo.; W. N. Wicks, Glasgow Telephone Exchange, Glasgow, Mo.; F. H. Whitaker, Topeka, Kan.; W. P. Patterson, Kansas Telephone Company, Ft. Scott, Kan.; F. S. Travis, Northwestern Missouri Telephone Company, Tarkio, Mo.; D. M. Martin, Oregon, Mo.; G. A. Wadleigh, Joplin, Mo.; P. Parker, Liberty and Olathe Telephone Company, Liberty, Mo.; J. M. Kennedy, Kirksville, Mo.; Geo. W. Crawford, Girard, Kan.; G. H. Spangle, Chetopa Telephone Company, Chetopa, Kan.; S. J. Bear, Topeka, Kan.; representing the American Electric Telephone Company, Chicago; E. H. Berry, Atchison, Kan.; W. H. Newberry, Monett, Mo.; C. E. Betts, Fayette Telephone Company, Fayette, Mo.; George R. Armstrong, Pierce City, Mo.; I. J. Kusel, Chicago, Ill., representing the Eureka Electric Company; A. J. Kusel, representing Electrical Engineering Publishing Company, Chicago, Ill.; William H. Chambers, representing TELEPHONY.

In President BaSom's opening address he said, in part: "In calling this annual meeting of the Independent Telephone Association to order, I want to congratulate you upon the representation that is made here to-day. There is no doubt but that such business as may be transacted may be beneficial to the independent telephone interests of the entire country.

"When the holding of this meeting at Kansas City was suggested, I for one was opposed to it upon the theory that Kansas City was opposed to independent telephone people; but since the meeting at Manhattan, I have become thoroughly satisfied that whenever an independent telephone company starts here with sufficient capital to connect with all of our toll lines, that Kansas City is ready to grant them such privileges and franchises as they are entitled to.

"When you take into consideration that in America to-day there are over 4,000 independent telephone exchanges that have sprung into existence within the last four or five years, and that millions of dollars of capital are invested therein, and that the business is in a prosperous condition, there is no good reason why Kansas City should turn its back upon a proposition of that kind. As I said at the start, I believe that whenever the people go before the council of Kansas City with capital behind them to build an exchange, Kansas City will do what it ought to do."

Upon motion of Mr. Armstrong the following committee on order of business was appointed: Mr. Woods of Seneca, Mr. Crawford of Girard, and Mr. Perkins of Coffeyville. The committee reported the following order of business:

First. Election of officers by ballot.

Second. Taking up new outline and covering new business.

Third. Deciding the next place of meeting by ballot.

Fourth. Discussion of benefits of organization.

On motion of Mr. Daugherty the report was accepted.

GEORGE R. ARMSTRONG, SECRETARY INTERSTATE TELEPHONE ASSOCIATION.

The following officers were then elected for the ensuing year:

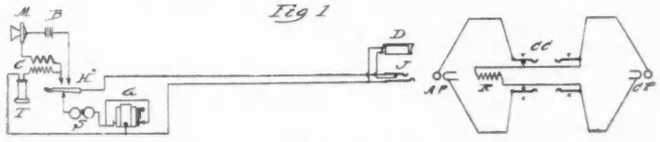
President, Mr. Fred R. BaSom; vice-president, Mr. E. H. Berry; secretary, Mr. G. R. Armstrong; treasurer, Mr. G. A. Wadleigh.

CHANGING A MAGNETO TELEPHONE SYSTEM TO CENTRAL ENERGY.

BY H. P. CLAUSEN.

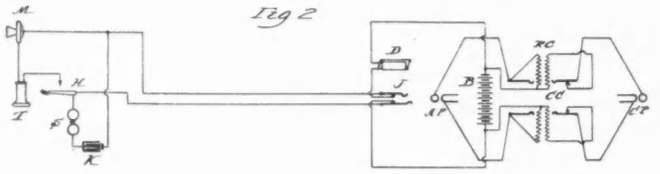
Believing that an article on the subject of equipping old magneto exchanges with apparatus suitable for operation on the central battery plan without requiring the discarding of all the apparatus used in the magneto system, would be of interest and undoubtedly of practical value, the writer prepared and begs to present the following article for the reader's consideration. It is, of course, well understood that in a magneto exchange system, the subscriber's equipment comprises a speech transmitter, speech receiver and speech current generator, together with the signal receiving, signal transmitting and switching appliances. In other words, the subscriber's station must be equipped with

Fig 1



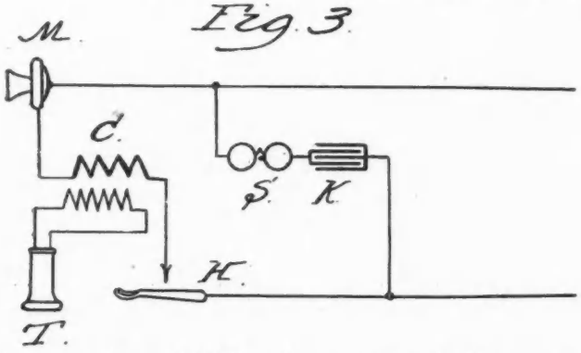
a local battery and means for permitting the generation of an electric current for signaling the central office operator for attention (usually by means of a hand-driven dynamo). At the central office terminal of the line we have the usual line-connecting spring jack and annunciator drop, together with the necessary switching appliances. Fig. 1 shows quite clearly in a diagrammatic way what represents the circuits of a magneto exchange system. Referring now to Fig. 2, we have a simple diagrammatic representation of a "central battery," or full central energy system. Examining first the subscriber's station equipment, we have the speech transmitter M and speech receiver T connected in series with

Fig 2



each other, the speech transmitter connecting directly to the tip line wire, while the speech receiver connects to the normally open contact above the receiver supporting switch hook H, which connects to the sleeve side of the line circuit. Attached to the body of the hook H, we have the signal receiver S, which is then connected to the tip line wire to the condenser K. At the central office it will be observed that the line signal D is connected one side to the tip of the jack and the other side to the battery B, while the sleeve side of the line is connected to the ground side of the battery. The cord circuits, it will be observed, are equipped

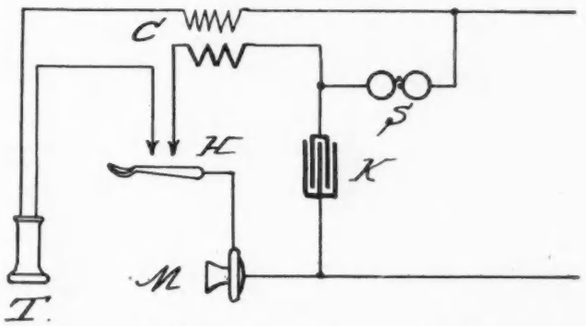
Fig. 3.



with a repeating coil R C, whose central windings are also connected to the battery B. With this system of circuits the calling subscriber is relieved of the responsibility for generating an electric current when signaling the central office, the only act required upon his part while sending in a call lying in his removing the telephone from its supporting switch hook, this resulting in permitting the battery B to project current over the circuit through the signal receiver D, and resulting in apprising the switchboard operator of the call for attention. Of course, when the switchboard operator responds to the summons, the answering plug A P is placed into the spring jack J (which results in rendering the signal receiver D inactive), and thus permits of the operator communicating with the calling subscriber. In its normal condition, the subscriber's station equipment does not permit of the passage through it of any direct current, owing to the presence of the condenser K, but upon the operator projecting an alternating current over the circuit the signal bell S would, of course, be set into action.

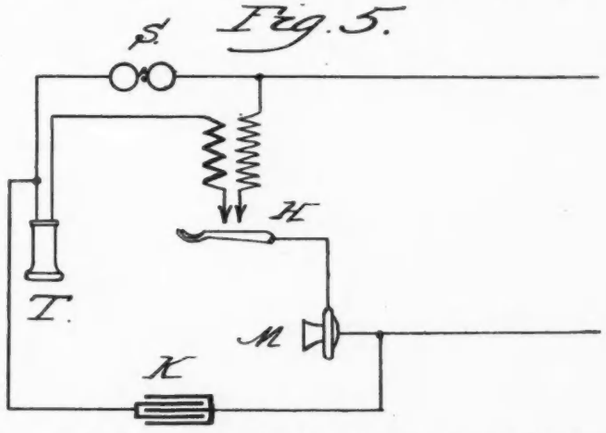
In order that the reader may gain an idea as to what

Fig. 4.



combinations may be produced in a subscriber's station equipment, the writer has prepared Figs. 3, 4 and 5. Each one of these circuits will operate, but it might be suggested that Figs. 3 and 4 are finding an extended application in practical service. The telephone circuit shown in Fig. 2 calls for the receiver and transmitter connected in series with each other to the line circuit, while the signal receiver is cut across the line circuit in series with the condenser K. In Fig. 3 an induction coil is used. The signal receiver it will be observed is still cut across the line circuits through a condenser. The telephone is permanently connected to one of the windings of the induction coil, while the transmitter is connected one side to the line wire and the remaining

Fig. 5.

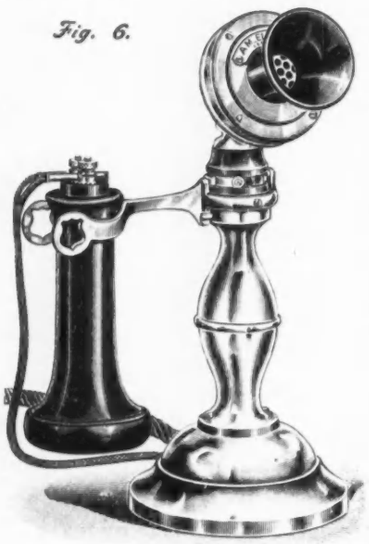


side to a winding of the induction coil, whose remaining end is terminated in a contact above the switch hook. Thus in its talking position the transmitter and one induction coil winding are connected in series with the line circuit. Referring to Fig. 4, it will be observed that the signal receiver and condenser are cut across the line circuits as before, but that the tip line passes through the P winding of the induction coil I to the receiver T, and through the latter to the normally open contact above the switch hook H. The S winding of the induction coil connects to the remaining open contact over the switch hook H, and to the junction point of the condenser K and signal receiver S. While this system of

circuits has been widely applied and in fact is now being largely used by several companies, it cannot be said to possess any great advantage over the system of circuits shown by Fig. 3.

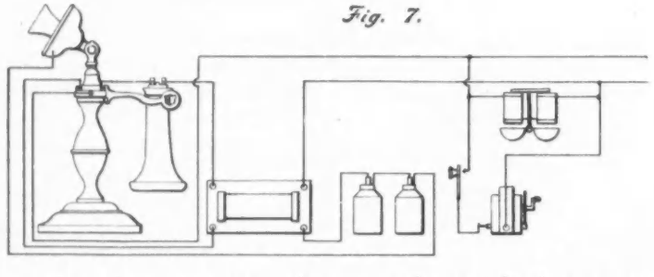
Fig. 5 shows a system of circuits in which the tip side of the line wire connects to the S winding of the induction coil and one side of the signal receiver S. The remaining side of the induction coil winding terminates at a normally open contact above the switch hook H, while the remaining side of the signal receiver S connects to one side of the receiver T and condenser K, which then connects to the sleeve side of the line. The remaining winding of the induction coil it will be observed connects to the telephone T and a normally open contact over the switch hook H, while the transmitter connects between the switch hook H and the sleeve line wire. This system of circuits has its particular advantage in that the line current does not pass through the telephone receiver during a conversation or while sending in a signal. This is a point which should be given some consideration in the selection of a system of circuits for central battery work. As for example, in Fig. 2, as also Fig. 4, an improper connection of the telephone receivers to the circuit would result in the line current exerting a demagnetizing influence upon it. This cannot, of course, occur in systems shown by Figs. 3 and 5, where the receiver is practically left clear from the line circuit.

Fig. 6.



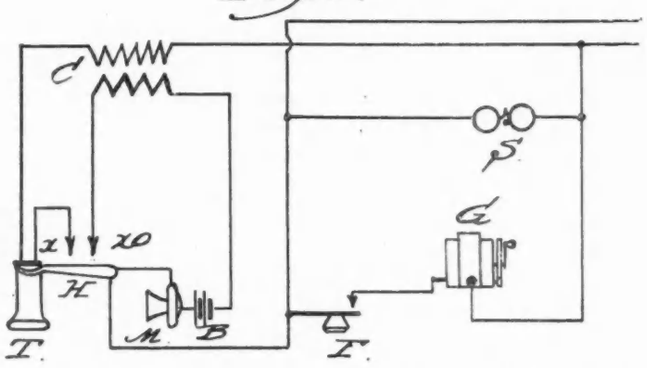
Now that we have gone over the question of central battery subscribers' station circuits, let us give our next consideration to the question of changing a magneto system to central battery. In the first place, it will be necessary to decide upon the system of circuits to be used, and while the central station apparatus is being reconstructed it will be necessary to pay a first visit to the subscribers' stations and change the apparatus therein and connecting the circuits in such a way as will permit of operating the equipment upon the magneto system until such time

Fig. 7.



as when the magneto exchange equipment is thrown out of service and the central battery board placed into operation. In making this change it must be remembered that it takes some time to change all of the circuits of the subscribers' station equipments to full central battery service after the exchange system has been thrown over onto the central battery switchboard, and that service must be given between the first visited subscribers' stations and to second visited telephone stations (or those which have already received their final change of wiring for full central energy system). The distinction between first visited and second visited subscribers' stations lies in the difference of the former being equipped with local batteries and signal current generators, while the latter are not equipped with either of the above elements. Furthermore, the difference between a first visited telephone station and a magneto station lies in the fact that a first visited station can be operated in connection with a central battery switchboard, while the magneto station equipment or original system of wiring does not permit of its being operated in connection with central battery switchboards, but first visited telephones can be operated in connection with both magneto and central battery switchboards. Thus it will be observed that if it is contemplated to change the operation of

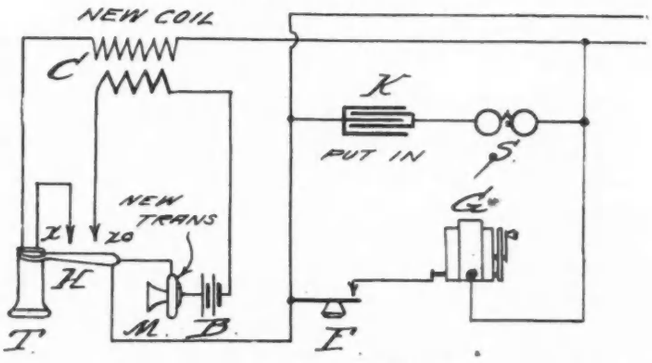
Fig. 8.



an exchange system from a magneto to central battery, the subscribers' stations must be visited twice. The first change must be of such a character as to permit of operating the changed telephone upon either the magneto call or central battery plan, and all of the subscribers' stations must be changed before the central battery switchboard can be connected to the circuits. Then again, after the central battery switchboard has been thrown over into service, a second visit must be paid to the subscribers' stations, producing changes in the circuits of such a character that will permit of operating first visited and second visited subscribers' telephone stations toward each other and in conjunction.

In order that the reader may gain a clear idea as to what it means to change over a magneto call telephone equipment to central battery, one example will serve to illustrate the proposition. Referring to Fig. 6, we have before us the view of a desk equipment commercially

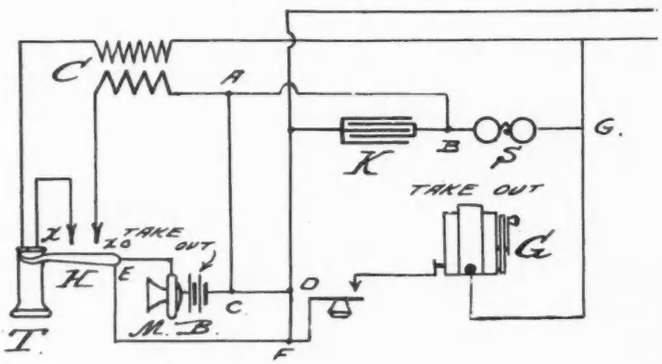
Fig. 9.



known as the American No. 41. The circuits of this instrument, arranged as it is for bridging magneto service, is shown in detail, together with its accompanying apparatus, by Fig. 7. Thus we have the transmitter M, speech receiver T, induction coil C, battery B, signal receiver S and signal current generator G. In order to more clearly show the circuits, Fig. 8 has been prepared and shows a skeleton circuit of the original wiring. Thus, it will be observed that the tip line connects to one side of the 80-ohm

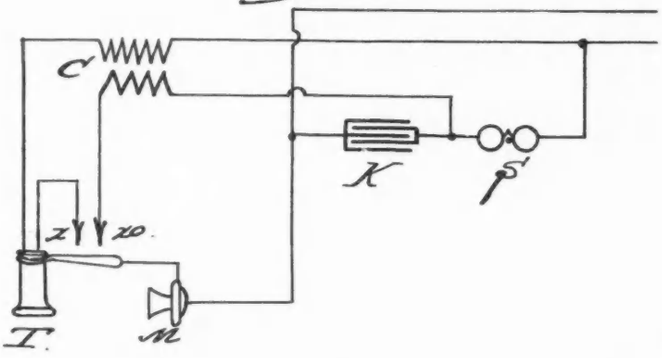
bell S, generator G and secondary of induction coil C, and through the latter to the receiver T and open contact X., the sleeve side of the line connecting to the switch hook, signal bell and one side of the normally open bridging generator G, while the transmitter connects to the battery B, primary of the induction coil C and to the open switch contact X O. Thus, we have the wiring of an ordinary bridging telephone. Now then, if this instrument, with the circuits disposed as shown, were connected to a central battery switchboard, it would not permit of a successful operation, and not alone that, even though it might operate by the simple addition of a condenser in the sig-

Fig. 10.



naling circuit, so much work would remain to be done after the central battery switchboard is connected to the circuit that it would result in a serious interruption in the satisfactory operation of the exchange. Therefore, on paying the first visit to such a station equipment, it would be necessary to make the changes indicated on Fig. 9, where we have before us the same diagram shown by Fig. 8, with the addition of a condenser in the signaling circuit. In addition to putting in the condenser, it would be necessary to change induction coils and transmitters from the magneto type to central battery. In the instance of the

Fig. 11



American No. 41 equipment, no change of the receiver would be called for if the circuits shown by Figs. 3 and 5 are adopted; otherwise a change of the receiver might have to be made. After all of the subscribers' stations have been changed similar to the above and the central battery switchboard thrown into service a second visit to the subscribers' station equipments would result in the addition of wires A B and C D and the removal of the wires E F, D F, F G and A C, together with the battery and generator G. After this change of circuits and removal of apparatus has been effected we have the circuits in their diagrammatic form, as shown by Fig. II

"WELL KNOWN HEADS OF WELL KNOWN HOUSES."

A BIOGRAPHICAL SKETCH OF EDWARD E. CLEMENT.

Mr. Edward E. Clement, whose portrait is presented in this number, was born in Hoboken, N. J., in 1868. He received his early education in the public schools of Brooklyn and Jersey City, and at the United States Naval Academy, Annapolis, Md., and took up the study of electricity and electrical engineering at an early age. He entered the Patent Office as assistant examiner in 1890, and in 1891 was appointed assistant in the division of electricity, and assigned to the classes of fire telegraph and telephony. In 1894 he prepared specifications and superintended the

EDWARD E. CLEMENT.

construction of the Interior Department telephone system, which comprised three switchboards. This was quite an undertaking at that time. For the last seven years he has been actively connected with independent telephone interests. In 1898 he associated himself with William D. Gharky, a well known telephone engineer. He has invented and patented a great deal of telephone apparatus, and is considered one of the best posted electrical engineers in the country. Mr. Clement is also a patent attorney of prominence, and is especially posted on all patents relating to telephony. He is entrusted with many important cases in this line, and is able to give them careful attention, although engaged actively in the telephone manufacturing business, being president of the Sun Electric Manufacturing Company of Philadelphia, Pa. Mr. Clement is a man of strong personality, and has a wide acquaintance with telephone men generally. He is a well known writer of technical articles, and has achieved success in all his undertakings.

BEST PAYING EXCHANGES.

C. F. BENNETT.

The question of the comparative profits of exchanges of different sizes is one to be answered in various ways, depending on the methods of the different managements. Thus a manager of a large exchange may be proficient in economical ways and means in matters connected with the expense accounts of a large exchange, while the same man may be incapable of handling a small number affair at a profit. In the one case the man may be clear on the methods of one simple exchange and again be very far from able to watch the surroundings of a score or more of small ones, with their distances from the base of supplies and with the conditions of country life and methods peculiar to the respective localities.

Then there is the matter of rates, which are the source of true profit. It is needless to say that an exchange of fifty numbers operated at fifty cents per month for residences and one dollar for business houses, will not pay, though it might exist if the rate were doubled, But the question is with the rates fixed at the highest schedule at which one station will be demanded for each twenty of the inhabitants, which exchange will pay the highest percentage of profit?

It is well known among telephone men that the cost of installation of an outfit of one hundred numbers in the ordinary city of two thousand people is very much less per 'phone for an equipment which will give good service than one of a thousand numbers in a city of twenty thousand. The cost of building exchanges is estimated as follows:

100 numbers complete, $40 per 'phone.
200 numbers complete, $40, plus $2.50, per 'phone.
300 numbers complete, $40, plus $5, per 'phone.

And so on.

This will make a 100-number exchange cost $4,000 and a 1,000-number, $62,500.

The basis of estimating the proper returns of telephone properties is as follows:

The nature of the business is such that until the financial public has such confidence in telephone securities that bonds are easily placed on a basis of 50 per cent of first cost, and at a low rate of interest, it must first be provided that a full 10 per cent of net profit remains after all expenses and allowances of every kind are made. To this add another 10 per cent for depreciation, and to this another 20 per cent for expenses. In other words, an exchange should earn 40 per cent of its cost each year. This places the schedule of monthly rates for service on an incline, going higher per 'phone as the numbers increase. This is customary and conforms to public demands. It also allows the expense per 'phone of operating to increase as required. A schedule in use by this system is as follows:

EXCHANGE SCHEDULE, January 1, 1901.
Rate per Month:

No. of Telephones in Exchange.	Residence 'phones.	Business 'phones.	Distance from Office.
Up to 50 'phones	$ .75	$1.75	Within 2 or fraction blocks
50 to 100 'phones	1.00	2.00	Within 4 or fraction blocks
100 to 250 'phones	1.25	2.25	Within 6 or fraction blocks
250 to 750 'phones	1.50	2.50	Within 8 or fraction blocks
750 to 2,000 'phones	1.75	2.75	Within 10 or fraction blocks
2,000 up	2.00	3.00	Within 12 or fraction blocks

All additional distance will add five (5) cents per block to the above prices.

Special rates for party-line service furnished on application.

There will be a discount from the above rates of twenty-five (25) cents per month if paid quarterly in advance.

Contractors, physicians, stockbuyers and others whose use of a 'phone at their residence is of a business nature, and who have no business 'phone apart from their residence, will in all cases pay business rates.

Now, on this basis, the question is solved, and it is evident that the large exchange pays the same profit that the small one does. And this is right. The question in the future, when rates and expenses are scheduled, should not come up except as is hereafter outlined, and until the time comes when prices are determined, not by telephone philanthropists, who makes rates at less than cost, but by those who desire to be safe first rather than to count their profit all in experience, there is this problem: What will be the net earnings in the large exchange as compared with the small at prices which are obtainable? And if these are equal, which gives the economical manager the better chance to grade up on his rates and to cut down his operating expenses without allowing the depreciation to exceed the customary 10 per cent?

To make a saving in labor in the small exchange is the easier, because there is a possibility of getting an apt operator to handle a larger than the standard number of subscribers per operator. Thus one might care for 200 numbers if the very best equipment is supplied. Skilled labor is of less importance in the simple work of the common return exchange, and a bright young man can soon learn to handle the problems without assistance. And the possibility of accidents in the small exchange is less than in the large.

As to the operating of small switchboards, it is possible to get good service with one operator up to over even one hundred and fifty subscribers. And this may be carried up farther to a limit which depends on the diligence and intelligence of the employe. I am not saying that this should be forced upon the employe, but it is a method of getting the man ready for a step higher, in which the company gets the benefit. Allow me to digress to say that there is in the level rate and expense system a way of protecting the worthy manager by granting him a percentage of the net profits over and above the standard, to be set aside as an interest-paying accumulation for his future pensioning, if you wish. But as the number of the exchange increases the possibilities for the advantages of extra good employes grow less and the routine expense and income become a part of the work.

Again, one fair electrical engineer can supervise a hundred exchanges of the one-section type at an expense of a trifle each per month. I do not think this would exceed $2. But the expense of engineering the troubles of ten 1,000-number exchanges or two 5,000-number exchanges would be very much in excess of this. True the increased income should exactly offset the extra expense, but this is where the danger comes in, for it is decidedly easier to stop little leaks than large ones. It is to be hoped that the day is soon coming when electrical workers will be as plenty as iron or wood workers. There is, however, the one feature which should be carefully considered, and that is the inability to obtain men whose minds hold beside electrical knowledge that executive faculty which must be proportionately developed to compass the work of handling the "live stock" of a great telephone system, as seen in large exchanges. This same generalship is needed, in my opinion, to handle investments of the same amounts in all cases, but in the case of the small exchanges it need not be accompanied by the expensive technical ability. We can find leaders among the common intelligent laymen. These often grow up into important positions in ordinary telephone work, but not so often in complex telephone fields. Abraham Lin-

coln said he could make generals, but had to buy mules. The fact is, however, generals are born and not made.

In a recent consideration of the possibilities of operating a combination of several of the largest railroad companies, the chief objection offered was the inability to secure the men able and willing to fill the responsible positions at the head. There seems to be a limit to man's own ability to oversee the works of his own creation. One can solve the simple problems of the checker game; with more difficulties are the intricacies of chess mastered, and it would not be difficult to create a maze beyond our reach. The same peculiarities apply to business affairs; and only those who grow into their complications can see the great problems without even offering a solution. In business the man who commands the knowledge and the faculty of applying it to the work of those under him has a portion of the world at least under his control. And he it is who has the arrangements, the permutations and the combinations of the telephone world under his control. They are unmanageable save to him who, in his zeal and skill, is still willing to forego the comforts of ordinary ability for the satisfaction of seeing great works accomplished. And these men ask and deserve great salaries for great accomplishments, which is a factor in this matter of profits which goes to the credit of the small exchange. True it probably is that money feels more secure in the hands of the great men, but it is still a fact that the ability to secure good men of little technical knowledge is far in excess of that to obtain the same number of good men with great technical knowledge, even were the money ready for their purchase. In other words, great enterprises are the measure of the men who execute them, and they will cost the price, which must be made a part of the work itself.

I therefore conclude that it is very much easier to create values along the lines of simple devices and construction than in the building up of that which must be subject to the weak points of the great and few, as well as the small and plentiful.

I desire to enumerate here the features of the successful handling of small exchanges of 75 to 300 numbers:

Build well.

Protect well.

Place central station in good living rooms.

Hire a good man and wife, who see to and help to build up the exchange.

Pay these a good price to live with the work, instructing them that they are to know everyone and are to respond to the call, the needs and the pleasure of everyone, and that they are placed there to serve the needs of both subscriber and employer at the least possible expense to all.

Remember the needs of these employes regularly.

Require absolute promptness in service and reports.

Require immediate removal of delinquents.

Favor patrons by giving the best of service, but never by conceding a discount for poor service.

Make every detail of the work subject to a method.

DEATH OF ELISHA GRAY.

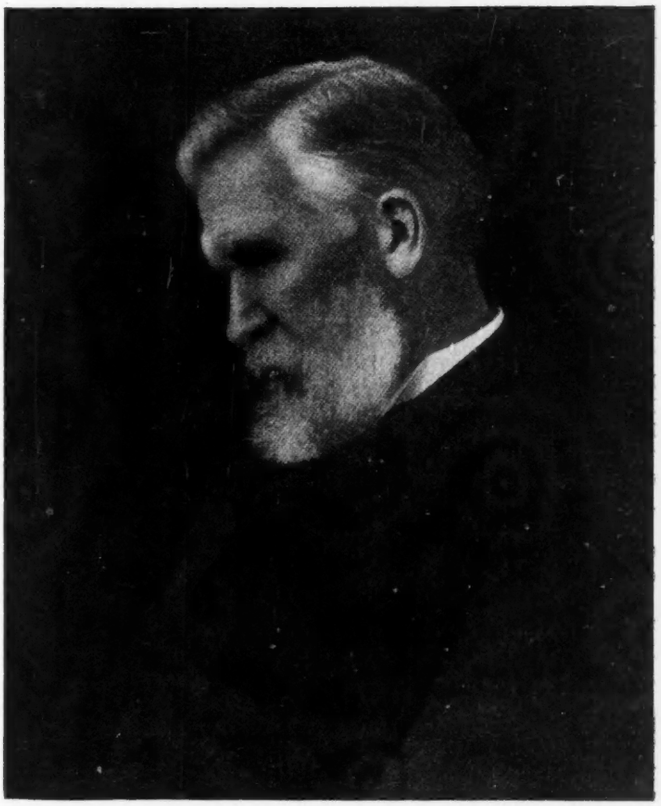
Prof. Elisha Gray, one of the most prominent electrical inventors in the country, who for many years lived in Chicago, died suddenly at Newtonville, Mass., on January 20. As Prof. Gray was not known to have been seriously ill word of his death came as a shock to his friends and business associates.

His death follows close upon the announcement that he had completed a number of important inventions. Recently Prof. Gray said he had nearly completed an invention by which he would be able to counteract the effect of submarine bullets and torpedoes, and it was supposed he had gone to the eastern coast to experiment with his invention.

Elisha Gray was one of the best-known of the electrical inventors of the day. In 1867 he began his series of inventions with a self-adjusting telegraph relay and two years later he established a manufactory of electrical apparatus at Cleveland. He perfected the typewriting telegraph, the telegraph repeater, the telegraphic switch and annunciator and other devices.

In 1872 he organized the Western Electric Manufacturing Company, but retired from it in 1874.

He invented his speaking telephone in 1876 and the telautograph in 1893. His name came very prominently before the public in connection with the great suit over telephone patents. He organized the congress of electricians in connection with the World's Columbian Exposition in 1893 and was its chairman. He was the author of several works on the subject of telegraphy and telephony.



PROFESSOR ELISHA GRAY.

The old inventor was born at Barnesville, O., August 2, 1835. After working his way through Oberlin College he became a ship joiner. With the filing of his patents at Washington began the great controversy between himself and Bell, which has made interesting telephone history. The conclusion of Mr. Bocock's article in this month's issue touches on the claim of Elisha Gray as the original inventor of the speaking telephone and there are many who believe he has more title to this invention than Alexander Graham Bell.

The annual meeting of the Illinois Telephone Association will be held in Champaign, Ill., on February 6, 1901, at 2:30 p. m. A notice has been sent out by W. B. Burke of Decatur, Ill., (who is secretary of the state association) calling attention to the importance of every man in Illinois interested in telephone work being present. The meeting is to be in the interest of the telephone companies, and a full program of unusual interest has been prepared.

Telephony.

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SOME NEW FEATURES.

Commencing with this number we publish Edward E. Clement's "Illustrated Digest of Telephone Patents" and the first installment of our "Course in Telephony," conducted by W. A. Taylor, both of which we believe will prove of unusual interest to telephone men.

Mr. Clement's "Digest" is too well known to need more than passing notice. It will cover all patents pertaining to telephony, commencing with those of issue January 1, 1901, and will be a permanent feature of the publication.

Mr. Taylor's "Course in Telephony," under the title "Telephone Troubles and Their Remedies," begins with an article on line trouble. This will be followed by switchboard and central office work, and in its turn every phase of telephony will be taken up and explained in detail. Mr. Taylor is a graduate of Cornell University and his articles will be based on the experience gained by years of practical telephone work.

TELEPHONY'S RECEPTION.

We desire to express our sincere gratitude for the kindly reception accorded the January TELEPHONY, and pledge ourselves to merit the support so generously given. In the whole field of trade journalism we do not believe—and we say this with becoming modesty—that the initial number of any publication ever met with such instantaneous success as our January issue. Within fifteen days after the publication was in the mails we received over seventeen hundred subscriptions; this statement we can prove. We append a few of the comments received and offer this issue as an earnest of the character of journal we will publish.

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Cleveland, O. Jan. 10. 1901.

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Gentlemen:-

Your letter of Jan. 5th was duly received and later I received your splendid Magazine, "TELEPHONY" I must say that I am very much gratified with your first effort. and can say that from the plans, as I have gathered them, of carrying on this Journal you will succeed beyond your fondest hopes.

I shall be glad always to assist you in any way possible in your efforts.

Yours truly,

James M. Thomas

J.M T.-L.

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Cleveland, Ohio."

"I have seen a copy of your January TELEPHONY, and I think you are entitled to credit for getting out such an interesting journal. ED. N. STEPHENSON.
(Continued on page 62.) "Waco, Tex."

ILLUSTRATED COURSE IN TELEPHONY.

CONDUCTED BY W. A. TAYLOR.

TELEPHONE TROUBLES AND THEIR REMEDIES.

Before taking up the subject of the correction of trouble in a telephone system it should be remembered that there can be no good service given unless all work is done in a first-class manner. There should be no temporary jobs done, if it is possible to prevent them, for it is generally the case that something will sooner or later turn up to prevent the return to such work; then after a while trouble will begin to increase in such an alarming degree that extra men have to be taken on to prevent being swamped with the work. It is always much cheaper, makes less labor and gives better satisfaction to the patrons to have all work done in a neat and workmanlike manner. It is especially desirable that all work done in connection with setting instruments and wiring houses shall be done neatly and carefully so as not to mar the walls or litter up the floors. All connections to the outside of houses should be made as inconspicuous as compatible with good work. This is very important as there are many people whose sole objection to the telephone is that the wires spoil the appearance of the house.

As employees come more or less into contact with the citizens of the place in which they work, they should always make it a point to be considerate and courteous, for their company's sake, if not for their own. It frequently happens that there are people who make themselves disagreeable, but they can be moved more by tact than by force. It frequently happens that a person can make a friend of one of these "chronic kickers" by going out of the way to please a little when otherwise he would become an active enemy.

Trouble in telephone work may be, for convenience, divided into the three general heads:

1st. Line trouble.

2d. Substation or instrument trouble.

3d. Switchboard and office trouble.

In addition to taking up the various troubles incident to the proper running of a telephone system, it should be understood that there will also be included a discussion on the proper maintenance of the apparatus so as to prevent trouble occurring.

The trouble man should be provided with a special portable testing set for the ordinary line tests for trouble. This set consists of a receiver, magneto, bells and switch. Fig. 1 represents a diagram of a very convenient form of testing set, L_1 L_2 are the two line connections, G is the small hand generator or magneto, B is the ringer or buzzer which is operated by the magneto, T is the receiver which also suffices for a transmitter. When the switch, S, is in the center position, the ringer and generator are in series with each other across the line. When the switch is thrown to the left the ringer is cut out and the generator alone cut across the line. This position is to make it possible to ring over a longer line or a line with partial grounds or high resistances. When the switch is thrown to the right the receiver is thrown into the talking circuit. In this position the magneto, if operated, will ring through the receiver making a buzzing sound, which is a much more sensitive test for continuity tests than a bell.

If the line is supposed to be open, the following is the method of testing: Connect one binding post of the testing set to one side of the line, and the other side of the line to the other binding post. Move the switch to the center position. If the bell or buzzer rings the circuit is closed, if not, the circuit is open. There is one exception to this which may mislead. If the line has considerable capacity the bell will ring even though the line is open. For all ordinary exchange work where there are no long lines of cable this test will always hold good.

A test for a cross is made by connecting one side of one line to the post of the testing set and the one side of the other line to the other post of the set. A ring indicates the cross. If the lines to be tested are grounded lines the line side in each case should be opened at each end and the test made on the line side.

In a similar manner a ground may be detected by ringing between the line and the ground. If the bell rings the line is grounded.

In case the lineman is out on the line and wishes to call up the operator he connects his instrument across the line and rings with the switch in the central position, then he throws it to the right and holding the receiver to his ear awaits an answer when he says what he has to say into the receiver, speaking quite loudly.

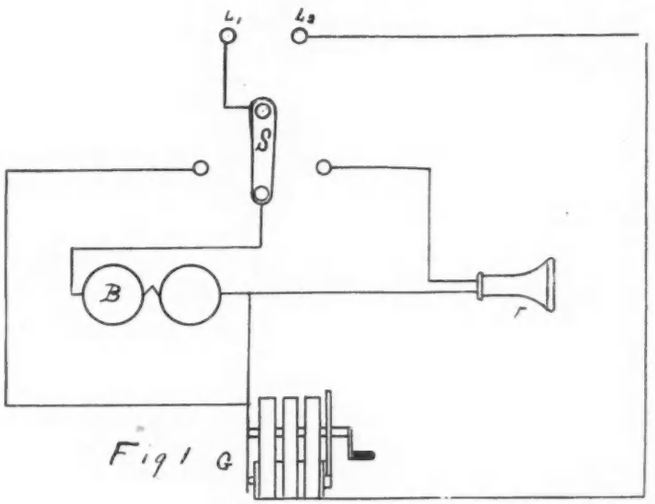


Fig 1

There is another form of lineman's testing set in the market which consists of a full telephone set put up with magneto, bell, receiver, microphone transmitter and battery. This set is put up in a very small space and is much more convenient to handle than the one shown in Fig. 1. There is an ingenious automatic switch on the side of the box which holds the receiver securely and at the same time cuts off the battery when not in use. Fig. 1a shows a test set of this kind. H and I are two clips placed on the outside of the box to hold the receiver R. H is rigidly attached to the box, while I is pivoted, so that when the receiver is hung up between the two clips they will separate. C is a contact bar which is on the inside of the box and rigidly attached to I at the pivot so that it may move back and forth only when I moves. K is a tension spring for the purpose of holding I against the contacts D and E, when the receiver is removed and also to hold the receiver tightly between the clips. The generator or magneto is what is commonly called a series generator and is arranged so that it always rings its own bell. When the receiver is placed in the clips the contact F is closed and then the testing set is in position for ringing over a line, L_1 L_2, but when the receiver is removed, contact F is opened and contacts D and E are closed, D closing the circuit through the battery G, transmitter T, and primary P, of the induction coil and also completing the secondary circuit to the line through the secondary S. of the induction coil and receiver R. The bells, B. are low-wound series bells.

It may readily be seen from the diagram that the set may not ring or receive a signal except that the receiver is in the clips.

The simple set described in Fig. 1 is in use very extensively throughout the country and has always given good service even when used over lines several hundred miles long. It possesses the advantage of being smaller and therefore more portable. It is also less liable to get out of order and can be used in any position.

There is another way to make continuity tests in which false tests, due to capacity, are eliminated, that is, by means of a receiver and battery. This testing arrangement is particularly useful where the magneto fails, due to presence of capacity. Fig. 2 represents the circuit. L_1 L_2 are the terminals of the circuit, B is a battery, R is a receiver. L_1 is connected to the binding post a, and with L_2 alternately makes and breaks the circuit at c. If the line is open a click will be heard in the receiver at first, but in subsequent contacts no click is heard. The reason of the click is that the line is charged up as a condenser and when fully charged no more current flows. If the line is not open there will be a sharp click in the receiver at each contact.

This method of testing is one of the most delicate, as an exceedingly small current will make itself known through the receiver. On account of its sensibility, the

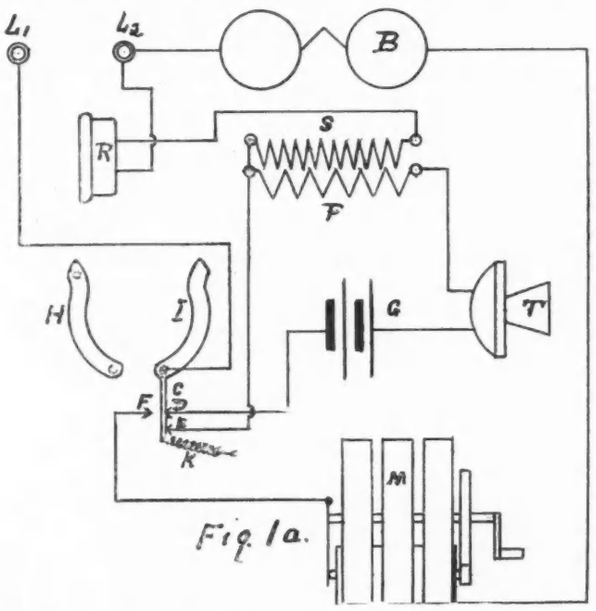


Fig 1a.

receiver in series with a battery of fifty volts is frequently used for the testing of insulation. The receiver is connected in circuit with the battery in the same manner as has been shown in Fig. 2. L_1 and L_2 should have their ends carefully separated at the farther point and if upon making and breaking the contact no sound at all or a very faint sound is heard in the receiver, after the lines are charged, it may be depended upon that the insulation between them is good. The contacts should be made in rapid succession, for if there is any considerable wait between each contact, the line will discharge, because of leakage and consequently there would be a click at each contact. The sound in the receiver will, of course, increase as the insulation becomes poorer.

This method, of course, requires considerable experience to know how strong a sound is made through a good resistance. A good way to educate the ear to this method of testing is to try it through insulation of known resistance, then the memory will come into play for future tests.

This test is, of course, only an approximate, and the accurate figures can only be made by the aid of a sensitive galvanometer.

In taking up a case of trouble the first thing is to find whether the defect is inside of the office or outside. The line in trouble should be opened at the terminals in the office and a test made each way, to see which way to go. If the trouble is inside another two-way test should be made at the distributing board. If the fault is outside, the next test should be at the outside cable terminals. If then

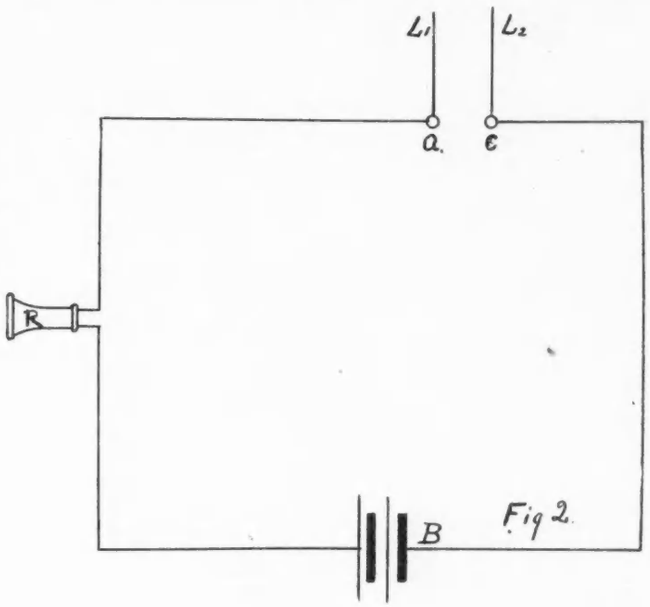


Fig 2.

the trouble is farther out, the lead should be followed up and the line in question watched carefully till the trouble is found or till the subscriber's station is reached. Then before examining the instrument, unless the trouble is in plain sight, the line should be disconnected and central called. If the line is clear toward the office, the trouble is in the subscriber's telephone. Thus it may be seen that a systematic way of getting at the trouble will definitely locate it in a short time. Of course, there are cases where trouble may be located without going over the entire line as above. For instance, a cross on two lines need only be followed to the point where the wires are not on adjoining pins.

The troubles on the line are as follows: Terminal troubles, such as fuses, bridle wires on cable poles, grounds, short circuit, crosses, open circuits, trees, bad connections, swinging grounds, poor insulation, slack.

Grounds.—These are caused by the wires coming in contact with anything electrically connected with the ground, as wires, trees, metal roofs, guys and also in some forms of protectors by a heat coil blowing, or dirty carbon arresters.

This trouble shows itself on long metallic circuit lines by making them noisy, but on short lines this trouble will not show up unless it is connected with a long metallic line, it will then be very noisy.

Where grounded or common return lines are in use, a ground shows itself as a short circuit. On some circuits a common battery located in central office is used for signaling. In one system a ground is thrown upon one side of the line which completes the circuit, and allows a battery current to flow through the signal out over the line through the subscriber's instrument to ground and thence back to the battery. In this system when a ground is on the signal side of the line, it will show itself by throwing a drop on the switchboard.

In stringing new lines, great care should be exercised in keeping all wires perfectly clear of all trees, buildings, or other obstacles which might interfere with the working of the lines. The wires should all be tied se-

curely to the insulators. It is only by having the lines perfectly clear that a minimum amount of trouble is experienced.

As an example of the difficulty caused by tree leakage, a case is cited where a limb not more than half an inch in diameter, touched the telephone wire and through the same tree an alternating current circuit of two thousand volts pressure passed, which was also touching another small limb. This produced such a disturbance, that the line could not be used. As often happens, the lines must pass through trees. In such cases rubber covered wires should be used and it is also a good idea to fasten insulators on the larger limbs which would be touched. The wire should not, however, be fastened tightly to the insulator, but so that it may slip through the tie wire. A good way is to wire a porcelain knob tightly to the limb and pass the wire through the screw hole. Then any swaying of the limb will not break the wire. Another way of supporting with porcelain knobs in a tree is by fastening a piece of wire to the limb and on the wire at a point a foot or more away from the limb fasten a porcelain knob with the wire passing around the groove. The line wire should then pass through the hole in the knob. The wire holding the knob should not be wrapped about the limb, but fastened to a nail. If the wire is wrapped around the limb it will probably kill the limb as it grows larger. This method gives greatest possible freedom for the swaying of the limb and the line will not be broken. If more than one wire passes through the same tree they

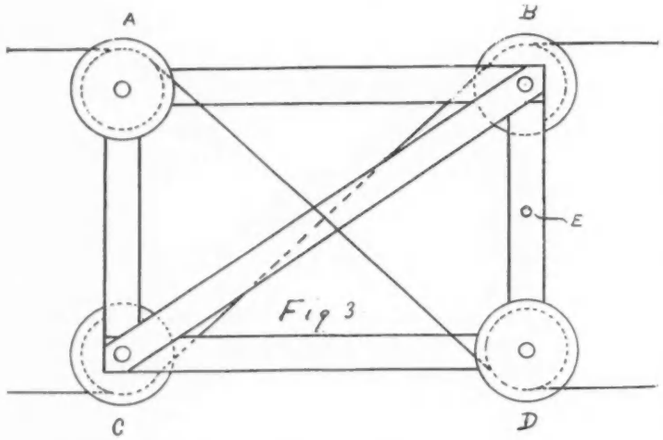


Fig 3

should be so strung that the swaying of the limbs cannot cross them. Great care should be taken here as a little negligence means the doing of the work again. In crossing over electric light or power wires always use rubber covered or the best grade of weatherproof wire, as the safety attained will more than counterbalance the extra investment.

Crosses.—When wires of different circuits become crosses. This is a common and perhaps the most frequent source of trouble and may be eliminated almost entirely by conscientious work on the part of the lineman. This trouble is caused by high winds shaking the wires, when they are too slack, and limbs of trees whipping them. Trim the trees back till they cannot do any harm, pull up the guys at the corners so they cannot give and then take all the slack out of the wires. If the lead is a long, straight one, exposed to the full sweep of the wind, side guys should be put on the windward side, at intervals of four or five spans, if the lead is a heavy one. If, after knocking out a cross the wire is found to be slack, it should be pulled up immediately. For this purpose a jackstrap or a pair of blocks and a comealong should always be carried when out on line trouble.

A cross on a grounded system shows itself very readily, for when the central office is called, more than one drop falls. The drops falling belong to the lines crossed. Crosses between metallic circuit lines will not show up except in very long lines, where there may be cross-talk. Practically the only way to discover a cross on a metallic circuit line is to see it while patrolling the lead.

On some forms of battery signal metallic circuits the signal is made by mometarily grounding one side of the line. In this case if the signal side of this line becomes crossed both signals in the office will fall when calling.

Short Circuits.—When both sides of one circuit become crossed with each other the same treatment applies here as in crosses, with regard to causes and their cure. In this case, however, there can be no transmission over the line, or if any, it will be very weak. In case of magneto signaling system, neither the office or subscriber can be called. With battery signaling with a common battery, or central energy system where the signal is made over a metallic circuit, the signal cannot be restored. Where the office is called by means of a common battery signaling over one side of the line, through the drops, the battery and the ground, the signal will work all right, but there can be no conversation.

A very easy way to tell whether a line is short circuited, without disturbing the line, is to attempt to talk with the operator over a good line that is connected with the line that is in trouble. If the operator cannot be heard or if her voice sounds very faint, the line is undoubtedly short circuited. If the short circuit is close by and of very low resistance, the operator will not be heard at all, but if the trouble is at considerable distance so that there will be a very apparent resistance between the trouble and the office, then the transmission will be weak.

Open Circuit.—Caused by breaking of lines, blowing of fuses, bad joints. Frequently where breaks occur the slack was pulled in the summer time too tight, and when the cold of winter contracts the wire the tension is too great for its strength. In mending broken wires, care should be taken to solder all the joints if of iron, or if of hard-drawn copper, use a sleeve connection. Hard-drawn wire should never be soldered, for the heat anneals it and consequently weakens it. Because of its brittleness a twisted joint should not be made in hard-drawn copper.

Wherever a copper wire is to be connected to an iron wire, the joint should be soldered, for if this is not done the joint corrodes very rapidly. The copper has a very corrosive effect upon the iron, due to electrolysis, and in a short time, if the joint is not soldered, it will have a very high resistance, causing trouble which is exceedingly hard to find.

Troubles from high resistance joints are probably the most difficult cases which occur in a telephone exchange, for they have a way of coming and going, not staying long enough to allow a complete test. Of course, when they remain long enough, it is simply a matter of climbing poles, calling back from each pole to the office, as you proceed along the line, until the point is reached where the office cannot be called; then it will be known that the trouble is between the last two testing points. Where the trouble does not stay in long enough the only way to do is to cut out all the joints in the line and make good ones.

In open lines, of course, unless the line is very long, there can be no transmission. But in long metallic circuit toll lines, one side of the line may be open and conversation still be carried on, though the line may be noisy. Open circuit lines may be tested out by means of test set connected in at the office terminal, having first disconnected the switchboard side; if the bell or buzzer does not ring, the line is open. An experienced operator can detect an open line by ringing over it. While she rings the line becomes charged like a condenser; when she stops ringing the line will discharge through her receiver, causing a click. If the line was not open there would be no condenser effect. However, through a long line with high re-

sistance and passing through a cable with quite a high capacity the operator may get the click in her receiver even if the line is in good order. This is a good test in all ordinary length of exchange lines. In exchanges using a common return wire, a high resistance or open circuit in a return wire will cross all the lines on that lead together. The fewer the lines the greater the cross-talk. On small leads of ten or fifteen wires a vigorous ring from a subscriber will cause all the drops of those lines to fall if the return wire is open, or a call from central office to one of these subscribers will ring the bells of all of them. In that case, if a note of the drops falling is taken, the trouble will be found between the subscriber on the shortest line in trouble and the next nearest subscriber on the same lead.

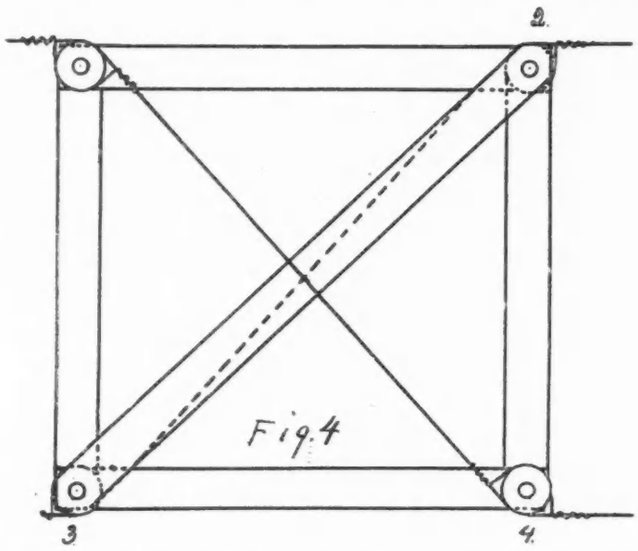


Fig. 4

In heavy leads no trouble from drops falling will be experienced, but in that case the trouble will be between the nearest subscriber's station, where cross-talk can be heard on the line and the next nearest subscriber, where no cross-talk can be heard.

Where metallic circuit cables are used and common return aerial lines, the cross-talk is frequently caused by trouble on the bridle wires of the cable terminal pole. Here one side of each pair goes to the line wire and the other side of each pair is connected to the common return wire. If by any means the return side of any of these cable conductors becomes disconnected from the common return wire, either from being broken or because of high resistance connections, there will be cross-talk caused. Great care then should be taken that these connections be soldered.

A frequent source of open lines is from broken spider or bridle wires on the cable terminal pole.

Induction.—The transmission between two or more circuits when there is no metallic connection between them. In this case we may have cross-talk when the lines are perfectly insulated or by induction. All of the lines of a lead may become noisy because of close proximity to a power or telegraph line. In exchanges where there is cross-talk due to induction, the trouble is due mostly to incorrectly connected or improperly constructed cable. When two lines are parallel to each other, one circuit, when in use has an electro-magnetic and an electro-static effect on the others, causing induced currents to flow in the affected lines corresponding to the voice currents. The closer together the lines are the greater is the difficulty, consequently in a cable where the wires are close together the inductive effect is greatest. On aerial wires in an exchange there is little cross-talk because the wires are far apart and comparatively short. But on long toll lines this trouble is often very apparent.

Where the trouble is in the cable and grounded lines are in use, they should pass through the cable as complete metallic circuits. Connect one side of each pair in the cable to the return wire, then if the cable is made up of twisted pairs, there will be no further trouble. The reason that the twisted pairs eliminate the trouble is that each side of each circuit is made to average equidistant from all the other circuits, hence we have the same effect upon each side of each circuit and a consequent neutralization of induction. In the old style parallel conductor cable it is harder to cure this trouble. About the only effective way is to open the cable every three or four spans, cut the conductors and transpose each of the circuits carefully so that the relative position of each circuit with respect to the others is changed. This method helps, but is at best guesswork. The best way would be to put up new modern cable and use the old on short branches. There are always places where old cable can be used to advantage in crossing trolley wires and turning corners with heavy leads.

Grounding the vacant wires of a cable will very materially decrease any cross-talk which may be due to parallel wires. However, there will be little advantage gained by doing this unless there are a considerable number of dead conductors, say about 25 or 30 per cent.

Induction From Electric Power, Light and Telegraph Lines.—As a line may pick up talk from adjacent telephone wires, so it may also pick up noise from electric light power and telegraph circuits, running parallel to it. In order to remove noise from the line due to such causes, measure the length for which the two lines are parallel, take half the distance and cut a transposition in telephone circuit. The exact point will probably not be found the first time, but by moving the transposition one way or the other the point will be readily found where no noise will remain. A convenient way to do this is to construct a movable transposition, as shown in Fig. 3. This transposition consists of a rectangular frame, braced so as to be stiff. On one side of the frame at the two diagonal corners are two grooved wheels made of hardwood, and on the other side, at the other two diagonal corners, are two other wheels. It should be made so that the frame is of the same width as the separation of the wires and about twice as long as wide. To place the transposition in the line, the wires on the noisy circuit should be cut and respliced transposed, allowing enough slack to remain so that the wires may pass tightly over the pulleys of the frame, the cross of the wire coming at the middle of the frame.

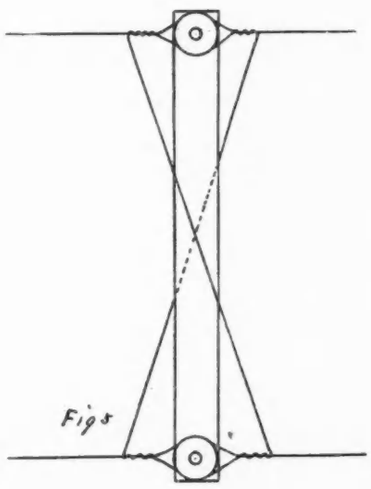


Fig. 5

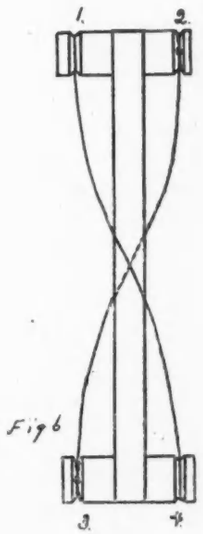


Fig. 6

We have then one wire passing over pulley A, diagonally across the frame and over D. The other wire passes

(Continued on page 53.)

THE INDEPENDENT TELEPHONE INDUSTRY FROM THE MANUFACTURERS' STANDPOINT.

BY J. G. IHMSEN.

It would be difficult to find an industry that has enjoyed such constant, uninterrupted and rapid growth as independent telephony in the comparatively brief period of its existence. It is only necessary to make a tour through the busy telephone factories of Chicago to discover the very healthy condition of the business. The employment of many hundred skilled mechanics working diligently in every department, covering many thousand feet of floor space, occupying every available inch of room, and turning out hundreds of telephones daily is a true index to the great demand for equipment throughout the country.

Many telephone users located at distant points, not having had occasion to visit the busy Chicago factories, are unaware of the large number of men employed and the vast amount of capital invested in the manufacture of independent telephone apparatus.

A natural query from the uninitiated would be, where do all the telephones go? Is it not probable that all the cities, towns and boroughs will be filled with telephones within the next year if the factories continue to manufacture and ship such enormous quantities of instruments? If an answer to the question was based upon the number of telephones placed in service during the seventeen years of Bell monopoly, it would be in effect that the limit has been reached, and the business is on the wane, but on the contrary the independent telephone business is still in its infancy, and expansion should be more rapid in future than in the past.

It is true that much of the best territory has been preempted, but plenty of good cities, towns and counties remain undeveloped. Those who consider the advance of the independent telephone industry excessive, lose sight of conditions that tend to make it a success, namely, a largely increased population, the necessity of rapid communication upon all business affairs, the appreciation by the public of a superior service and reasonable rates that have placed the telephone within reach of thousands who have heretofore declined to accept a service at exorbitant rentals.

From a monetary view it is difficult to find an investment that will yield a larger percentage of profit, than that derived from a perfectly constructed and well equipped modern telephone plant. It is to be regretted that even a very few of the Independent plants have seen fit to sell out to the Bell Company or its licensees, accepting probably a small profit with quick returns in preference to retaining and developing an enterprise that would undoubtedly yield twenty times the accepted profit in a short time. The very small minority of short-sighted ones will soon see the error of their ways, and discover too late that the franchise and privileges given them by the citizens of this commonwealth for the express purpose of maintaining an improved service in competition with the common enemy, and which rights they have so lightly traded for a trifling gain, cannot be again obtained for all the gold in South America, where they are killing men every day to obtain possession of a field, the like of which is now open to every American of ambition and enterprise desirous of entering the independent telephone field. It will perhaps have a beneficial effect to clear the horizon from the clouds that have always been threatening, and we who have our hearts in the business will see to it that new independent plants are again built up in the towns that have been sold out.

A closer community of interest amongst the manufacturers is a consummation devoutly to be wished and any movement tending to greater harmony should be heartily encouraged. The benefits resulting from closer business relations between the manufacturers would be mutual and far-reaching. In the matter of credits alone, much could be saved and many of the unpleasant features of the business eliminated. While the telephone purchasers generally are an acceptable risk and prompt pay, yet there are some, as in every line of business, unworthy of our confidence, and they should be deprived of the opportunity to continue their methods. The most threatening aspect that presents itself to the independent field, is the tendency to lower prices which applies to the telephone exchanges, as well as to some manufacturers. I do not believe that the better class of subscribers want a telephone service for nothing, nor for a price less than the cost of such service, and some independent exchange owners have made the fatal mistake of beginning upon a rental entirely inadequate. Neither do I believe that the better and wiser exchange owners or party line owners, want us to furnish them with telephones at a price below a reasonable profit. If an exchange is your customer, they are interested in your earning a reasonable profit and laying up a surplus. Your failure to charge a price for telephones, sufficient to accomplish this result, leaves but very slender protection to your customer, and I feel confident that 90 per cent of the telephone buyers would prefer to pay a fair price, such as will allow a fair profit and permit of maintaining a high standard in apparatus, the deterioration of which is inevitable unless reasonable sales are effected.

It is a lamentable fact that some manufacturers have deemed it expedient to encumber their factories with orders at every unprofitable prices, probably with a view of introducing their apparatus; but be the cause what it may, I most sincerely hope that all my fellow manufacturers and all purchasers (who have been harassed by the attempted use of inferior instruments) join in my recommendation, that all telephone apparatus should be improved where it is possible to do so in preference to allowing prices to reach a point so low as to prohibit progress and improvement.

It is most gratifying to all manufacturers to note the improvement being made in the quality of independent construction. A costly but impressive lesson has been learned by those who several years ago built their plants or toll lines with materials of indifferent quality, and others entering the field are undoubtedly profiting by the past experience of the ones that are of necessity compelled to rebuild their exchanges. A very common error in the past has been made in underestimating the ultimate requirements of the contemplated exchanges, which were accordingly built with short poles, insufficient cable capacity, limited terminal facilities, curtailed exchange accommodations, and last, but not least, in many instances, capital inadequate to provide for the necessary additions to accommodate the increased demand for service. These conditions were not entirely created by a desire to follow inexpensive methods, but largely by inexperience pertaining to the business generally, and an inclination of conservative investors to discredit the possibilities of independent expansion; even after a few years experience, when abundant precedent existed, it was difficult to convince promoters and builders that provision should be made for an increase of from 200 to 300 per cent on the initial installation.

To the staid old merchants who had been for years contesting vigorously for supremacy in local fields, the statement that new business would come to the independent telephone company more rapidly than it could be provided for, seemed incredible and all advice from the manufacturers failed to effect a change of opinion. I am delighted to observe that this fault is not prevalent to any extent in recent installations, and hope to see it disappear entirely. The

building of exchanges in the larger municipalities has introduced a number of competent electrical engineers into the independent field, and their willingness to aid and advise the management of smaller exchanges, has effected a remarkable improvement. Such suggestions from disinterested sources are more readily followed in preference to a manufacturer's advice, who is as a rule unjustly suspected of entirely selfish motives.

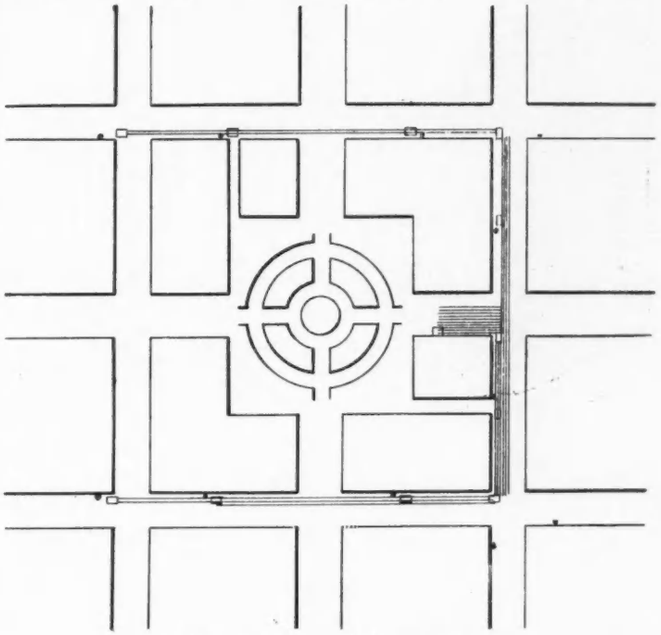
At this point it would be well to comment upon the relationship existing between the manufacturer and purchaser. Nothing that can be written under this caption can be applied to all purchasers, nor to all manufacturers, but generally speaking it is my impression that the manufacturer does not receive full credit for the important part he plays in the independent field. It would require many pages to describe the ups and downs of this industry in the earlier days, the discouragement encountered in the introduction of any acceptable plan to successfully combat the monopoly, the difficulty of securing capable help in the mechanical and electrical departments, the seeming impossibility of dispelling the fears of the timid, the herculean efforts employed to hold the independent plants together in the gloomy days following the reversal of Judge Carpenter's decision, the harassing struggle to overcome a prejudice and influence exerted by an opponent with unlimited financial resources, the apparently endless task of defending unjust legal actions, and patent litigations, sinking almost in despair under the burden of an unequal competition, only to emerge finally bearing the independent banner as an emblem of victory. All of this and much more has the manufacturer done in the past, preserving by his courage a lucrative field for investment in which the purchaser has been wise enough to participate.

There does not appear to exist between manufacturer and purchaser that degree of sympathy and harmony that is so essential to the power of the independents. The purchaser is prone to view the manufacturer in the light of one chiefly designing a scheme whereby he can most successfully extract from the exchequer of the aforesaid purchaser, the largest amount of money for the least amount of apparatus, but I feel qualified in asserting that such a suspicion (if it is prevalent) is erroneous, and while I have been unable to discern many indications of unlimited generosity or philanthropy amongst the manufacturers, yet I feel confident that they are devoting their best efforts in the purchaser's interest in an endeavor to produce the highest grade apparatus possible at prevailing prices.

"I regard the initial number of TELEPHONY as phenomenal in the field of trade journalism. In one bound it lands in the front rank and stands as a leader in its special field. I am sure both reader and advertiser thoroughly appreciate your journal, and that you have captured their hearty and best wishes for your continued success. F. A. DAWES, Downers Grove, Ill.

NEW MONMOUTH ILLINOIS EXCHANGE.

The Independent telephone exchange being constructed in Monmouth, Ill., by Jones & Winter of Chicago will be a modern plant in every particular. The accompanying drawing shows the location of the exchange proper, and the scope of the underground work, which underlies the entire business district. The pole lines commence one block from the public square and are built with fifty-five-foot Idaho poles, one to each block. The pole lines in the outlying districts are thirty to fifty-five feet Idaho and Wisconsin cedar, furnished by the Valentine-Clark Company and John H. Fowler of Chicago. The conduits have a capacity for 1,500 full metallic lines. The accompanying photograph shows the method of laying the underground conduits and gives a fair idea of the class of work being done. The central office equipment will consist of five one hundred section, flash light transfer system switchboard. Five one hundred pair Cook's full protection terminals and five one hundred pair cross-connecting strips, the entire equipment, including telephones, being furnished by the Sterling Electric Company of Lafayette, Ind. The exchange will open for service by April 1, 1901, with about three hundred and fifty subscribers. There will probably be a thousand small exchange and farmer telephones connected during the present year, about six hundred being already arranged for.



PUBLIC SQUARE, UNDERGROUND SECTION.

UNDERGROUND WORK, PUBLIC SQUARE.

SOME EARLY EXPERIENCES.

BY A. E. DOBBS.

In these days when any beginner in the telephone field can buy nearly all the information he needs, information that is thoroughly up-to-date and based on a quarter of a century's experience, at so much per volume, it is rather amusing to glance back to the early days, when the foremost men in the business had everything to learn and no previous experience to guide them.

In those days we looked on a man who knew enough to take care of instrument trouble or connect up a switchboard as a wonderful electrician, and the few men who could do that work were inclined to lord it over the "trouble shooters."

The only available linemen in those days were recruited from the telegraph ranks, a brave, free-hearted lot of men, whose experience had been gained in "rawhiding it" in the country, and woe be to a new man among them who pretended to an experience he did not possess, for the advent of a new man into the gang was a signal for a general rush to run him out, and if he could not "keep his end up" he might as well quit when his day's work was done.

There was a fascination about the work that kept the men in it as long as they were able to work at all, and as they gained experience the best of them were located at some station or exchange as troublemen, where the work was comparatively light, and where, in course of time, they might expect to reach a higher grade; many a well-known official to-day started in life in this way.

The writer, however, was more fortunate in having served but a short apprenticeship at climbing, till he was placed in an exchange as troubleman.

Up to that time he had never talked through a telephone and as his inexperience was plainly evident, the older men used to play all kinds of tricks on him. On one occasion, they kept him hunting all day for a cross between two grounded lines, that was caused by a fine, number 36 copper wire, so cunningly concealed that only the closest inspection revealed its presence.

Another time, a certain lineman, who had a grudge against another, went out and cut a line which was on porcelain knobs, put a splice in it, "dead ended" it around the knob, wrapped the other end with tape and also deadened the taped portion around the knob, giving it the appearance of a continuous line, but, of course, with the taped end insulated from the other, making an open line. The unfortunate victim of this joke looked for his trouble a week before he found it. They had no test sets then and it was a great deal of trouble to cut or ground a line for a test.

In those days in New York, an outside man was not allowed to open an instrument and if a test showed the line "clear," he immediately reported it to the office and an instrument man was sent out to fix it.

This made a gulf between the "dudes" and the "telegraph men" wider than that between the upper and lower West Point classmen, and a young fellow who wanted to learn it all had a hard row to hoe. Reading every book I could lay my hands on—and they were few at that—gave me a smattering knowledge that convinced "the dudes" that I knew some of the secrets of their trade and many of them were kind enough to tell me all they knew, which was little enough after all. When other means failed, I used to get into an argument with someone I knew possessed the necessary information, which was adhered to right or wrong till someone offered to "bet you the drinks" and before the bet was paid they had to prove me wrong—all of which resulted in my acquiring a great deal of information at a comparatively small cost. When the "long distance" lines were first opened to Philadelphia, the length of line suggested the necessity of talking at the top of the voice, and manager and operators alike shouted till they could be heard in the next block, till one day one of the operators in experimenting discovered that a conversation in an ordinary tone could be heard equally as well, which was likewise a nine days' wonder.

There were many curious mistakes made in those days of grounded circuits. In one instance, there was a small village so located that water could be reached anywhere by driving a ground rod down to a depth of two feet, and in consequence none of them were driven deeper than that, and many of them less. That was all right in the summer time, but when the ground froze up in winter the whole community was cut off from the outside world. We then learned that ice was a pretty good insulator.

In another part of the country we found a place where the dry earth made a fairly good ground, but in explanation it might be added that the earth was full of minerals. At another time, in a sandy soil, a ground rod, driven more than ten feet, failed to give satisfactory service.

Another time some linemen thinking to get a good ground at a railroad tank, tied a piece of railroad iron to the ground wire and dropped it to the bottom of the tank. The tank being a wooden one, fed from a spring on the side of a hill by means of a pipe run in from above, had no direct connection with the earth, and it took these men quite a while to understand that an isolated body of water did not necessarily constitute a good ground connection.

It also took us quite a while to comprehend that certain sections of the country, owing to rock or shale formation—even including their ponds and streams—might be practically insulated from the rest of the world, though giving a good service to local telephones in that district.

In one case, several lines were badly crossed together, though opening them at the instruments and calling for an office test showed them "clear." This troubled the lineman for quite awhile, till it finally occurred to him that, perhaps, as there were three of four telephones on one ground rod, that the trouble must be caused by a poor ground, and such proved to be the case. A separate rod for each instrument remedied the trouble. Of course, nearly everyone is now familiar with the possibility of lines connected to gas or water pipes becoming crossed through disconnection from the street service of the latter, but it has kept many a lineman guessing in times past, and catches them even now, occasionally. It has not been so very many years since a switchboard in a large exchange became badly troubled with cross-talk and all kinds of expedients were tried by the manager to locate it. After nearly a year's worry, someone found out that the gaspipe to which the connection was made, did not make a ground connection, as there was a rubber hose connecting the house service to the street. It was only a very short piece of hose, used for convenience in turning a corner, but it was enough to make a very noisy board.

This reminds me of another sapient "electrician" who grounded a line to a railroad track, and then looked for three days to find out where the resistance in his line could be; for even men who ought to know better still have an idea that a piece of iron or a tank of water, no matter how situated, will always make a good ground.

I remember how I surprised one of these gentry once by showing him that under a certain amount of contact

he could not ring an ordinary magneto bell with a pail of water looped into the circuit.

Of all troubles, a swinging ground is probably the most aggravating, as it is often hard to locate, and the faith of some linemen in annunciator or any other covered wire is beautiful to see and wire of this kind was often hung across a roof or around sharp cornices, with no other insulation or protection than the covering of the wire. Sometimes it lasts for years without weakening, and then again, it doesn't.

In one case, I remember weatherproof wire was used to connect from a cable box to the lines, and in order to protect them from injury they were pulled through an iron pipe part of the way, which was all right, but for one thing; the pipe was bent around the pole and turned up at both ends, and not sealed. Of course, the first rain filled the pipe full of water and it was not long before there was a great deal of cross-talk in that lead as might be expected.

Another very common form of trouble has been caused by placing two wires under one staple in house wiring.

Trees always have been a source of annoyance to telephone men, but one very aggravating case of trouble was a cross that came in late at night and cleared itself about 9 o'clock next morning, which was caused by morning glory vines, which would make a cross while wet with dew, and, of course, clear up when the sun had dried the dew off. It goes without saying that in this case beauty had to be sacrificed to utility.

Another mysterious trouble seemed to come in during the hottest part of a warm summer day and go away about 3 o'clock. After a great deal of careful watching the cause of the trouble was found to be due to the expansion of the wire which allowed it to touch a tin roof.

Another somewhat similar cause was found in cold weather, when the contraction of the wire drew it up against a guy, which in turn was grounded.

When lead covered cables first came out, the conductors were generally wound with two wrappings of cotton thread; cable terminals were to a great extent very inefficient and the need of housing them was not well understood; ends were often left unprotected altogether and there was a great deal of leakage and cross-talk. Later someone found out that by laying up the cable in pairs and grounding the mate of each pair, a great deal of cross-talk could be removed, but as cables cost more in those days than they do now, the temptation to use every conductor in them was very strong—more especially owing to the fact that the growing popularity of the telephone made pole space for the additional wires quite a serious problem, and as there was no opposition in those days a considerable amount of cross-talk was taken as a matter of course, and the service, poor as it was, was a great deal better than none at all, and the demand for telephones steadily grew.

I can well remember with what wonder we went around to see the first multiple switchboard and how it was the talk of the telephone crowd for many a day. Nor can I forget that distributing boards, fuses and protectors, as well as many other things that we take these days as a matter of course, were then very crude affairs, being genrally mounted on wooden strips placed against the wall and wired with annunciator wire.

SOUTHERN OHIO TELEPHONE ASSOCIATION.

At a meeting held at the Cherry Hotel, Washington C. H., Ohio, on the 16th inst., the Southern Ohio Independent Telephone Association was organized for the mutual interests of the local independent telephone companies in Ohio south of a line east and west through Columbus.

Mr. G. P. Thorpe, secretary The Clinton Telephone Company, Wilmington, Ohio, was chosen president, and I. S. Henkle, secretary Mt. Sterling Telephone Company, was made secretary.

An executive committee of three was elected, consisting of the following named persons:

Chas. D. Duncan, secretary The Home Telephone Company, Chillicothe, Ohio.

F. W. Peirce, secretary The London Telephone Company, London, Ohio.

Jerome Penn, vice-president The Citizens' Telephone Company, Washington C. H., Ohio.

The next meeting of the association will be upon call of the executive committee.

TELEPHONE TROUBLES AND THEIR REMEDIES.

(Continued from page 49.)

over C and B in like manner. Now, by fastening a hand-line at the point E, the frame may be pulled along the line as far as may be needed, that is, until no further noise is heard. The pulleys, or wheels, should be fairly large, say six inches, and the frame quite long, so that the wires will not have a short bend over the pulleys, and also that the frame may be easily pulled along. The reason that the neutral point is not generally found in the measured position, is that the disturbing circuit is never absolutely parallel, owing to different length of spans, different amount of slack and crookedness of the line. Where disturbing lines parallel a telephone wire for more than a quarter of a mile, it is best to cut in two or more transpositions, for with but one it is doubtful whether the line can be completely balanced.

When the neutral point is found, measure the distance from the pole to the point and cut in a permanent transposition there. Do not think that the nearest pole will do, for it is surprising how small an error in placing the transposition will leave the line unbalanced. A very durable transposition may be made from cross-arm braces. Make a stiff, square frame and on each corner fasten a strong porcelain knob, and in these knobs make the transposition with insulated wire, as in Fig. 4. 1, 2, 3 and 4 are the porcelain knobs; 1 and 4 are on one side of the frame, while 2 and 3 are on the opposite side. One wire passes over and is tied to 1 and 4, the other is tied to 2 and 3. Another form is as in Figs. 5 and 6. This is lighter and for that reason to be preferred in some cases, when the wire is not heavy. A piece of stiff strap iron, or what is better, a piece of strong hardwood is used. On opposite sides of each end are placed the knobs 1, 2, 3 and 4. Heavily insulated wire should be used. One wire is fastened around 1, where there are several twists of the end around the wire, then the end passes around to the opposite side of the strip and is fastened to 4, from which insulator it continues along the line. The other wire is in a similar manner fastened to 2 and 3. It will be seen that there is a strong twisting stress on the wood or iron cross-piece, and for that reason it should be very stiff.

The frame shown in Fig. 4 is probably the best where the wires are heavier than number 10 B and S, but for number 10 and smaller Figs. 5 and 6 will do very well.

According to the Novoe Vremya, of St. Petersburg, Russia, the old postal telegraph system between Siberia and European Russia has proved so deficient and unsatisfactory that the matter is now receiving the consideration of the government. The first wires were laid in July, skilled men hurried to the scene of the operations, and the Siberian papers already comment favorably on the progress made.

"Your January issue of TELEPHONY to hand, and I consider it the best paper published to-day. I would not be without it.

HENRY ROBINSON,
Portland, Me."

A VIEW OF CORPORATIONS FROM THE STANDPOINT OF THE INVESTOR AND STOCKHOLDER.

BY GRANT NEWELL.

ARTICLE II.

From the legal point of view, the corporation organized for the purpose of conducting a telephone business differs in no essential particular from those organized for other purposes, except in so far as statutory law may have broadened its powers or added to its obligations. As an instance of the extraordinary powers sometimes granted to companies organized for the purposes under discussion, may be mentioned that of condemnation, i. e., the right to take private property under certain conditions and upon certain terms, for the use of the corporation in the prosecution of the objects for which it is organized. Besides the several classes or kinds of bodies corporate mentioned in our former article, such organizations are also known as public and private corporations, and, still further, we find a form of corporate existence in its nature partaking somewhat of both the public and private, as denominated in the law quasi-public corporations, so called from the fact that their functions are exercised for the benefit of the public at large, though their management and ownership are in the hands of private parties. This class of corporations are generally endowed with certain rights and privileges and burdened with various liabilities not possessed by or imposed upon the ordinary business company. Among such corporations are transportation companies of various kinds, gas and water, telegraph and telephone companies, etc. The effect of the special provisions, necessarily incident to incorporated bodies of this nature, upon the rights of the stockholders therein will be discussed in the article following, and for the present we will continue the investigation of the rights and liabilities of the stockholder where the same are unaffected by these special provisions. In the first place, then, as to his rights. These may be briefly summed up as (1) that of voting and thus having a voice in the corporate management, (2) to participate in the dividends when declared, (3) to be entitled to his proportionate share in the proceeds of the corporate property (after all liabilities have been discharged) on the winding up or dissolution of the company. The pecuniary liabilities imposed upon the stockholder arise out of his contract of subscription for the capital stock, and may be enforced (1) by the corporation itself and (2) by its creditors in the event of its becoming insolvent. As between corporation and stockholder, the contract of subscription, when untainted with fraud, will govern, and once the subscriber has paid the amount agreed upon, the corporation cannot call upon him further, even though such amount be less than the face value of his certificate of stock. But when attacked by the corporate creditors the shareholder must respond, irrespective of his agreement with the corporation, until he has paid the full amount expressed by the par value of his certificates. In other words, shares of stock issued and marked as fully paid or non-assessable will protect their holder as against the corporation only, and not as against its creditors. As to the latter, it is always an open question of fact as to whether the stock is or is not fully paid up.

The liability just discussed is designated as the contractural or common law liability of the shareholder, and in addition thereto, by statute in many states, and especially with reference to certain corporations, a further or additional liability is imposed on the holders of stock. This is known as statutory liability, and as a matter of course is always provided as a special remedy for the protection of the corporate creditors. Very nice questions often arise between creditors and shareholders in cases where the latter claim to have discharged their liability on stock subscriptions, by transfers to the corporation of property or property rights in lieu of payments in money. Of course, where things so transferred had a market value at the time of the transfer and were taken by the corporation at such value and so credited to the account of the shareholder, the problem is easy of solution, but where the thing so transferred had no market or other tangible value the matter becomes one of great difficulty. To illustrate: If a subscriber for certain shares of the capital stock of a corporation organized for the erection and maintenance of a telephone exchange, he could beyond doubt pay such subscription in cedar poles to be used by the company in its business, but suppose he desired to make such payment by assigning to the corporation letters patent for a device, the practicability and consequent value of which was as yet undemonstrated? In the latter case the weight of authority is that as against creditors of the corporation A would still be liable upon his stock subscription.

The common law liability of the shareholder is very generally increased by statutory enactments whenever the stockholder fills the position of an officer or director of his corporation. And, indeed, to common law and statutory liabilities are frequently added certain penalties to be imposed upon persons when acting as officers or directors for acts of omission or commission against the state, and this is known as penal liability. But inasmuch as both such statutory and penal liabilities may be readily avoided by the exercise of ordinary care and common honesty on the part of officers and directors, no one capable of exercising the former and willing to observe the latter need hesitate to accept the position of officer or director in an incorporated company, solely because of the additional liability thereby incurred.

In considering the functions of officers and directors mention should be made of the prime necessity of making and preserving complete and authentic records of the proceedings of the company, when convened either as stockholders or directors. The matter of "keeping the minutes," as it is familiarly called, is one which is far too often neglected, entailing consequences which are, to say the least, unpleasant to all parties concerned. These "minutes" are the evidence of the proceedings of the corporation, and by which it is bound in all matters wherein the courts are called upon to pass on its prior transactions, its business methods, or its manner of conducting affairs.

Having said this much upon the matter of the liabilities and obligations of the shareholder, it may now be well to revert to his rights and privileges. And first we should understand that the mere holding of a certificate of stock, even though indorsed to the holder thereof, does not constitute one a shareholder in the corporation, for one can become a shareholder in the eye of the law only in one or the other of two ways—(1) by an original subscription to the capital stock, or (2) by the purchase of a certificate from a shareholder, followed by the surrender of such certificate to the corporation and the issuance of a new one in lieu thereof in the name of the holder, and a proper entry of the transaction upon the books of the company. It is not until one or the other of these methods is pursued that the rights of a shareholder attach. The first and perhaps most important privilege of the shareholder is his right to vote. This right may generally be exercised either in person or by proxy, but it should be borne in mind that a director cannot cast his vote by proxy; he must attend in person upon all meetings where he desires his vote to be

recorded. This rule arises from the fact that the body of stockholders are of right relying upon the director to exercise his discretion in managing the affairs of the company on their behalf, and that where one person serves another in a representative capacity in matters involving the exercise of discretion, such acts of service cannot be delegated. Secondly, the stockholder has the right to participate in the dividends when declared. As set forth in the preceding article, the matter of declaring a dividend is one entirely for consideration and determination by the board of directors, but once a dividend is declared, the rights of the stockholders attach and they may severally maintain actions at law against the corporation to recover the amount due them on such dividend. But if such stockholders are indebted to the corporation on their subscriptions to stock or otherwise, it may set up counter claims in such actions by stockholders, and the amounts of such counter claims may be deducted from such sums as may be due on the dividends so declared.

Now, in organizing corporations, and perhaps especially those similar to telephone companies, where in general the number of shareholders is large and the amounts of individual subscriptions comparatively small, the "backers" or moneyed men of the company, being desirous of obtaining control thereof, very frequently adopt the expedient of increasing the capital stock, and thus practically destroy the voting power of even the aggregate of the minor stockholders.

In order to avoid this unsatisfactory proceeding it is suggested that such stockholders should at the outset insist upon a resolution being passed to the effect that in event of an increase of the capital stock at any time the new shares of stock so to be sold on such increase shall first be offered pro rata to the then stockholders, thus giving them preference in point of opportunity to purchase additional stock, and so to retain their original power in the management of the affairs of the corporation.

Having now discussed somewhat at length those provisions of law applicable to corporations in general, the next article will be devoted to an examination, from a legal standpoint, of those principles more especially applicable to those corporations which are engaged in the field of telephony.

LONG-DISTANCE TELEPHONY.

BY J. H. LENDI.

In view of some recent publications of improvements in both aerial and submarine telephony it may not be out of place to give in a descriptive manner the action of a long-distance telephone line.

The question of long-distance telephony presents the problem of the transmission of energy in its most complicated form, for not only must the wave form originating at the transmitting station be preserved as nearly as possible, but it must also meet with the least possible loss. The first condition implies that of the many pitches constituting a particular tone, each is to suffer the same rate of decay, that is, each pitch should undergo a loss proportional to its amplitude, this taken together with the fact that pitches ranging from a few hundred to several thousands of vibrations per second must be transmitted simultaneously, will perhaps make the above statement more easily appreciated.

The quantities that enter into the transmission of articulate speech electrically, and that are effective in denying us the realization of a perfect telephone line are the resistance, distributed inductance and distributed capacity.

The effect of resistance is, of course, to decrease the current as the distance from the transmitter increases and because of the great sensibility of the receiver, imposes no very serious trouble, since by simply increasing the diameter of the wire such a difficulty could be avoided. So far as resistance alone then is concerned, it is simply a question of whether or not the telephone traffic between the two points connected would warrant the additional expenditure in copper. The inductance is the property of a line that retards the current waves behind those of the impressed E. M. F., and is analogous to property of inertia in mechanics. Inductance is due to the fact that an alternating current or, in fact, any variable current must continually overcome its own field force.

The magnitude of the inductance per unit length is given by the equation

$$L = \frac{P}{2} + 2 \operatorname{Loge} \frac{d}{r},$$

where U represents the permeability of the wire, d = distance between the parallel line wires, r = radius of the wire.

The distributed capacity of a line is the element that causes the principal difficulty in long-distance telephony in that it causes varying rates of decay for various pitches. This is, of course, a serious trouble, since if of the various frequencies constituting a particular tone, those of higher frequency suffer a greater decay of amplitude in proportion to their amplitudes than those of lower frequencies, the resulting tone in the receiver will be of poor quality because of the undue prominence given to the lower tones. Again the capacity causes different frequencies to be transmitted with different velocities. This difficulty, however, causes no serious trouble since, first, a phase displacement between two waves started simultaneously is not appreciated by the ear, and secondly, the difference of the velocity of propagation between different waves is so small that the belated wave is not very likely to modify by overlapping the wave immediately following it. It is well known that the effect of distributed capacity may be eliminated by means of a proper amount of distributed inductance. Now there is a certain relation between the magnitudes of the capacity and inductance of a line that will make what has been called by Heaviside a distortionless line. Such a line transmits all frequencies of importance in telephony with the same velocity and the same rate of decay. To put a line in a distortionless condition seems then to be the end to which we must bend our efforts to secure perfect telephone transmission.

A mathematical analysis shows, for instance, in the New York-Chicago line that the inductance is much too small to make the line distortionless—that is, in order to make the New York-Chicago line distortionless it is necessary to in some way increase the inductance. The use of iron instead of copper would increase the inductance, but at the same time another difficulty would make itself manifest, and that is the skin effect. The skin effect is due to the inductance and current in the conductor which distributes itself in such a manner as to make the inductance least. For that reason not all the metal of the wire is equally effective in carrying current and consequently the increased apparent resistance. Bimetallic wires have also been suggested for this purpose, sufficient iron being distributed on the copper and in such a manner as to produce the required inductance. But the method that seems to be the most practicable, and that can be applied to existing lines, is to bridge impedance coils at intervals across the line. The size of these impedance coils for a given distance is a matter of experiment and seems to be the basis of the recent developments in telephony.

"I am glad to have the opportunity of congratulating you on TELEPHONY. I hope you will stick to your text and make your publication readable for the twenty-five thousand telephone workers in the United States.

GEORGE H. GLASS, Gen. Mgr.,
Lynchburg Telephone Co.,
Lynchburg, Va."

THE EVOLUTION OF A TRUNK CIRCUIT.

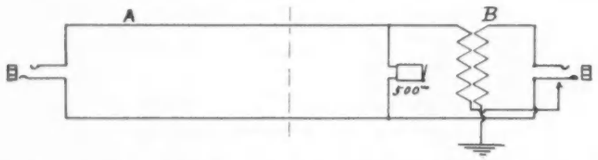
BY J. C. KELSEY.

When this telephone system was purely local battery the various systems of signaling were comparatively simple. The average lineman or inspector was "expert," and was fully capable of handling any difficulty. If any trouble could not be found quickly, it mattered not, for there was plenty of time. But in these piping days of competition and pride these old, careless methods have gone into disuse. We will call the originating operator A and the receiving operator B.

When A had a call for the other city she simply plugged in outgoing trunk jack, rang on it and washed her hands of the whole affair.

When B saw her drop fall she answered and asked the subscriber once more whom he wanted, and called the party.

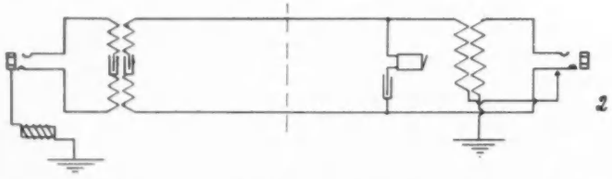
In this particular system the A exchange was cut to common battery one year before B. To make the trunk comply to new conditions and give A proper supervisory signals, a condenser was inserted in the 50-drop circuit, making the entrance of B's plug show to A's supervisory



signal signs of her action, because the extra spring of the jack closed the repeating coil. When B pulled out the circuit was left opened, A's supervisory lamp lighted up and she pulled down the plugs.

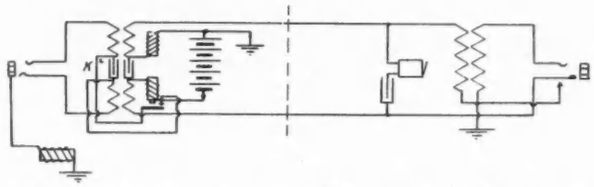
This straight trunk brought another difficulty into play, wherein a grounded party calling for B's side found the trunk so noisy as to be unfit for conversation. This was caused by the unbalance coming from the repeating coil, having one-quarter of its winding short circuited, and consequently out of use.

This necessitated the use of a repeating coil directly in the circuit, which, while it balanced the trunk, had a bad effect on ringing, and destroyed the proper supervisory effect. As soon as A inserted her plug in the trunk jack her supervisory signal showed that B had answered immediately. This had one evil effect. If B's drop didn't fall down or A forgot to ring, her signal showed that she had, anyway, so the only recourse left to the subscriber was to attract the operator's attention and ask her to ring again. To keep A's supervisory signal from showing that B had answered before she really had, condensers were inserted in this manner:



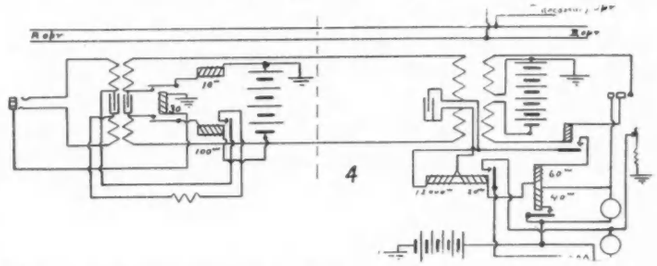
This had an equally bad effect, inasmuch as it never showed when B answered, but the lighted supervisory signal still reminded the operator that the connection needed attention, and the consequence was that she would often ring on a busy trunk—that is, her parties were already talking.

To insure proper supervisory signaling, the repeating coil was furnished with battery and balanced relays, one of whose contacts was used to short circuit the condenser or, more properly, to close the switchboard circuit and operate the supervisory circuit. They were inserted in this manner:



In this circuit, as soon as B answered, the signals of supervision were done just as if the line was clear.

But one thing was wrong. No disconnect was ever given when B withdrew her plug. The relays were noticed to be sticking. All manner of tilting and adjusting was done and still the relays stuck—that is, the armatures stuck. Investigation proved that the discharged spark of the charged condenser K_2 on the switchboard side, welded the platinum contacts and thus retained them until a smart tap dislodged them. In this particular case, 110 ohms inductive resistance was inserted at X. This increased the time factor of discharge and decreased the intensity of the spark. This resulted in only a blackening of contacts, but welding was entirely eradicated. This circuit seemed to be satisfactory and was in operation a full year. Then the B exchange was cut over to common battery, and this necessitated change in circuit and change in manner of operation. An order wire was put in use, and when subscriber asks for a number his operator repeats it to B, who names the trunk and calls the desired party. While B is putting up connections, R, the recording operator, has recorded the numbers and watches the time of conversation. It is not necessary to record the experimenting and trouble ensuing from new conditions, but entirely new features were put into use. In B's set was a high-wound relay, which was operated by A's plug being inserted fully into the jack corresponding, and which would not operate A's supervisory lamp till B's party answered. When B's party answers, A's supervisory and



B's supervisory lamps both go out. But when B's party hangs up, her supervisory lamp does not light up, because the relay is locked; only A's supervisory lamp lights. When both of her signals are clear she pulls out plug, which releases B's clearing-out, high-wound relay and allows the clearing-out lamp to light, whereupon B takes down her connections, the originating operator always having full control of the connection.

As the repeating coil was still necessary for quiet connection for all classes of service, and as the clearing-out relay at B depends upon battery at A, one can see that B would have a permanent signal, one that was always extinguished and consequently unfit for use.

The trouble was overcome in this manner:

When A plugs in her sleeve contacts operate the relay which puts battery on the trunk through the two balanced relays.

This battery operates the high-wound relay. When B's party answers, instead of 12,000 ohms alone in the circuit, we also have 80 ohms in parallel with it, which readily permits the balanced relays to operate, which, in turn, act on the cord relay and supervisory lamp. When B's party hangs up, the 80-ohm circuit is opened and 12,000 ohms alone exists. This is too much for the balanced relays, which promptly release their armatures. This gives A her supervisory signal and she withdraws her plug. The relay is then opened and battery no longer exists on the trunk. The high-wound relay releases its armature and the clearing-out signal is given to B, who promptly pulls down her connection. The compound locking relay is released and is ready for another connection.

This system of trunking seems to be nearly flawless, the system of operation is the fastest and trunk trouble is easy to locate. When a lineman cuts in a transposition the compound locking relay will not lock, it will actually sing. The same note heard by ear close to it is heard in the telephone at either end of the trunk. Ordinarily nothing but defective heating coils affect the daily routine operation of these trunks.

AT THE 'PHONE.

Maud Muller, on a summer's day,
Called "Number, please?" to earn her pay.

Before her, numbers, printed small,
Fell down when any one would call.

The Judge took down his office 'phone,
And made to Maud his wishes known.

Said he, "I'll ask you just once more,
For four-eleven-forty-four."

Said Maud, as mild as summer seas,
"What number did you ask for, please?"

Said he, "I told you twice before,
It's four-eleven-forty-four."

Said Maud, and you could hear her smile,
"Just hold the 'phone a little while."

A weary interval ensued,
The wires hummed an interlude.

And broken bits of talk came o'er
The 'phone, and made the waiter sore.

The wishbone-shaped receiver hook
He seized upon and wildly shook.

Till Maudie's voice he heard once more,
"What number are you waiting for?"

The Judge responded with a roar,
"It's four-eleven-forty-four."

Serenely Maud made answer then,
"That line is busy; call again."

The Judge had business late that day,
And so he merely walked away.

But as he walked he shook his head,
And this is what he sadly said:

"Of all the words of tongue or pen,
The d—dest are 'Busy; call again.'"

—From the Portland Oregonian.

The telephone wires at Waterloo are being laid underground. The other day when the conduit was all ready, a rat was put into one end and a little while later a ferret with a string tied to his leg was sent after him. Both arrived at the other end in a remarkably short time and the wires were pulled through by means of the string.

TRADE NOTES.

ROTH BROS. report a heavy increase of business during the past few months, and are going to greatly enlarge their factory and make extensive improvements.

THE EUREKA ELECTRIC COMPANY, Chicago, wishes to call attention to its new twentieth century catalogue, which will be sent to anyone upon request. Catalogue contains complete description of all apparatus.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY has just closed a contract for putting in a 500-line exchange in Wellsville, N. Y. The company is doing a good business and is putting new apparatus on the market.

THE NATIONAL AUTOMATIC TELEPHONE COMPANY is now located in its new factory at 155 Jackson Boulevard, where it has twice as much space as in the old plant. It has added a large amount of new machinery, and is putting out a line of apparatus which is meeting with great favor.

THE SUN ELECTRIC MANUFACTURING COMPANY, of Philadelphia, reports a large number of orders received since January 1st, and states that the export business of the company bids fair to take a substantial proportion of the output of the factories. Ample provision has been made for the increased business, and the company is prepared to make prompt shipment of all orders.

THE INDEPENDENT TELEPHONE SUPPLY COMPANY, Chicago, Ill., announces that it has for sale 10 bridging, 50 series, and 10 desk set telephones of standard make, which it offers at $9.50, $7.50 and $5.50 respectively. This company reports a considerable increase in business since the first of the year, and will send its new catalogue upon request.

THE MOON MANUFACTURING COMPANY, Chicago, reports a splendid year's business. Especially have the sales of the Moon fuse terminal head been very large. This device is claimed to insure exchange apparatus against loss or damage from electric currents. Full description of this well-known terminal will be sent upon request. Address the Moon Manufacturing Company, Chicago.

THE LINDSLEY BROS. COMPANY, of Menominee, Mich., which has been in the cedar pole business for a number of years, states that it has in its various yards ready for immediate shipment, about 10,000 dry poles. It is able to furnish product from its Michigan and Wisconsin yards, or extra long poles from the yard at Portland, Ore., and makes a specialty of prompt shipments.

THE HARVARD ELECTRIC COMPANY announces that there is a special demand for its distributing boards, which are being used in several large exchanges. It is also receiving many orders for single and double-pole combined, fusible cut-out and carbon lightning arresters with upright carbons. Mica fuses are well made and tested at factory, and are meeting with great favor with exchange managers. Twentieth century catalogue will be sent upon application.

GEORGE W. CONOVER, 1511 Monadnock Block, Chicago, has closed an arrangement, whereby he will represent the North Electric Company and the American Toll Telephone Company, both of Cleveland, Ohio. These companies are installing a complete exhibit of their apparatus in Mr. Conover's offices, where prospective customers are invited to see it in actual operation. Mr. Conover is an old Bell telephone man, and has had many years' experience in both the telephone and electric business. The arrangement to handle the product of the above companies in the West has been made as an auxiliary to his purchasing and forwarding business, in which he has been very successful.

A TELEPHONE MESSAGE FROM GOD.

BY FRANK GOEWEY JONES.

The night editor's desk was half buried in "copy." "Fresh proofs," "flimsey" and "specials" were on each of a dozen spindles. The floor—well, there was a floor somewhere beneath the litter of clippings and the remnants of "butchered" stories. Paper white and yellow; paper printed, scribbled; paper thick and paper thin; paper, paper everywhere. The roaring of the pneumatic tubes; the click, clack of the telegraph keys, and the harsh rustling of the rubbish underfoot, when stirred by the hurrying feet, all these were part and parcel of the making of the "Morning Herald," a twentieth century American newspaper.

Noise, confusion, disorder and—tobacco smoke are necessary to get out the first edition of a metropolitan daily and if the merit of any particular issue may be measused by an overabundance of these necessities, the coming edition of the "Morning Herald" certainly would be beyond compare.

Never had the copy boys hurried so fast and so noisily; never had the floor and tables been so encumbered with rejected copy; never had the "pencil pushers" so rapidly covered their paper with the history of their assignments; and never, no, surely never, had everybody smoked so much and so vile tobacco as upon that night. And why? Because the "old man" was cranky, nervous and worried. His curt commands, couched in words which fairly exploded from his lips, called for instant and unquestioning obedience. The oldest reporter, who, in token of his ancient rights and privileges, habitually loafed with his feet on a desk at the corner window, that night was busy in shirtsleeves, collarless and hatless, beneath a green shaded lamp.

There was a big strike on in the city. The day had been one of rioting and violence beyond the power of the police to check. "Extra men" were sending in copy by messengers and half a dozen telephones were busy receiving the latest details of events in outlying districts where disorder was at its height. It was past midnight and every man was working as if his life depended on it to get in his copy before the forms should be locked for the early edition. The very essence of a city's, of a nation's, pulsating life was there in that dingy room.

Over all the rushing, noisy confusion ruled one man, the omnipotent night editor. Henry (or, as the cub reporter called him behind his back, "Old Harry") Withers was a spare, tall man of forty. Eyes like two flashes of lightning; a nose long, thin and white; lips that shut like the shell of an oyster and fairly snapped on each word; a shock of grizzled hair shadowing the huge cheekbones, and companion to the bushy brows. These were the details of his face. He was a man of imperious nature with a will of iron and nerves of steel. Never till that night had he seemed to lose control of every minute detail of the office. Then, however, he was plainly "rattled" and made up in impatient surliness what he had lost in strength of mind and will. It could be no trivial matter which so disturbed him.

At every "Brr-rr" of the telephone on his or his assistant's desk he started violently and the lines about his eyes and mouth drew tighter as if with a spasm of pain or fear. As minute succeeded minute, and hour succeeded hour, he bit his nails to the quick and the torn flesh bled. His eyes were dry and hot with aching. At intervals a cold tremor would run from his feet to his head and down again to his feet. Would the suspense never end!

At last the belated "stories" all were in and the last proof was read. He gave the word to close the form and the office men gathered up their pads and pencils, prepared to leave for home.

Again the telephone buzzed and he heard the operator's drowsy "Hello, is this Mr. Withers?" "Yes, yes," he fairly shouted. It seemed an age before he could speak to the person at the other end of the line, so long did it take the caller to find his dime, drop it into the box and push the button which gave the signal to connect the line.

Really it was only a moment, but in that brief space of time the night editor's mind had traversed the years of his bachelor dreariness; had shown the bare and cheerless rooms where he dwelt and called it home. Clear, also, was the recollection of the first meeting on that warm spring morning at the park, the meeting with the sweet, fair girl whom at first sight he loved. How short seemed the time since the long sought for introduction, the hoping, the wooing, the winning and the wedding at the quiet church of his boyhood. Before his eyes came the picture of the bright home she made him and of the two years of love and gladness. Oh, how like a dream it all was!

In the evening he left her, the strike in the city making his presence at the office imperative—left her, the dear face so white and drawn with the pain of her travail, one thin, marble hand outwhitenin the snow of her pillow. Back from her forehead the damp brown tresses were brushed. The blue of her eyes was veiled in the tears of suffering. Her poor little mouth was a-quiver and trembling. Oh, if he only had known it could be like this! If he might but have known one-half of that agony she suffered that his joy might come.

Long they had waited and wonderfully they had planned for the little stranger who was to come. The day dreams had been sweet plannings of what the child's life would be and now the dream was ended. For the possible life of her infant his darling must give up her own.

They had been so happy together and he had loved her well. Now he was to hear she had left him—dreary and sad and alone. The doctor had said that evening that her chance was but one in a hundred for life, and had insisted upon strictest quiet, which only might save her to him. If she might sleep there was hope. In the afternoon the baby boy was born; and convulsion after convulsion shook the weak frame of the mother. The crisis must come before morning, and if she had not found rest in sleep the long last slumber would come. The crisis had come and over the telephone the doctor was speaking to him. The listener's heart stood still in his anguish.

"She is sleeping, Harry, my boy. The crucial point is past; the worst of the danger is over. She must be kept perfectly quiet, but with good nursing your wife will get well. The baby is sleeping beside her and is a fine little chap. Good-night."

Good God! is it true? Blessed, merciful Father, is it, can it be true? Not dead; not dying, but living—living and will get well. Had he heard it aright? Yes, the calm, clear words of the doctor had meant that she would get well.

He hung up the receiver blindly. His face had a radiant look—a look as of one who had opened the portals of heaven and looked in on eternal day. Then a reflex of emotion overcame him, and the tears of relief rained fast on his face. His lips in an ecstasy of loving kissed the 'phone for its message from God.

ANOTHER INDEPENDENT VICTORY

In the suit of the Western Electric Company (acting for the Bell Telephone Company) against the Citizens' Telephone Company of Grand Rapids, Mich., the American Electric Telephone Company and P. C. Burns of Chicago, a decision was rendered by Judge Severens, January 8, 1901, in favor of the defendants.

When the switchboard was first installed by the American Electric Telephone Company at Grand Rapids, Mich., the Western Electric Company (acting for the American Bell Telephone Company) immediately commenced a series of suits, directed against the Citizens' Telephone Company of Grand Rapids, which installed the exchange at that place, for the asserted infringement of many different patents owned by this company.

One of the most important and far-reaching patents known as the "Eldred," was alleged to have been infringed and suit was brought by the Western Electric Company in June of 1896, against the Citizens' Telephone Company of Grand Rapids, for the asserted infringement of a patent to one Horace H. Eldred. This patent contained four claims upon which the complainant relied to stop the defendants in the use of its switchboard.

These claims covered among other things the use broadly of a switch or key in the cord circuit, to be used for cutting in the operator's set, for the purpose of answering and listening. Another claim relied upon covered broadly the use of a power generator as a means for signaling the called subscriber from the switchboard. One of the other claims relied upon related to and covered broadly the interposition of a calling drop in the circuit, so that the drop would be cut out and removed from the circuit upon the insertion of a plug into the jack. The other claim relied upon related to the use of a clearing-out signal device in the cord circuit.

In view of the breadth and scope of these claims and insomuch as they covered vital features in the operation of any and all switchboards, the American Electric Telephone Company, stopped at nothing in the way of expense to properly defend the case and since the year 1896 up to the present time has been engaged in the taking of testimony and the defense of this case. Thousands of dollars have been spent in obtaining witnesses and in attorney's fees in order to defeat the unjust claims of the American Bell Telephone Company, based upon this patent. An enormous amount of testimony was taken and finally after an elaborate argument of the case before Judge Severens, at Grand Rapids, Mich., a decision was rendered by the judge on January 8, 1901, dismissing the suit.

In many respects the litigation of this patent afforded opportunity to illustrate the methods by which the American Bell Telephone Company seeks to cripple its competitors. Possessed of an exclusive monopoly for the term of 17 years under the original Bell patent, this corporation was enabled to purchase from inventors patents upon which to bring a multiplicity of suits against competitors after the expiration of the original monopoly. In its endeavors to cover every feature in the development of the art, patents were frequently issued to those having no just claim to the inventions described, and in many cases owing to the display of favoritism and oppression, patents were issued to the wrong persons.

In the year 1878, James W. Brailey entered the employ of the Chicago Telephone Company, and shortly after he became the superintendent of construction for that company. During this period Horace H. Eldred was the general manager of the Chicago Telephone Company, then known as the Bell Telephone Company of Illinois, and it was in the latter part of 1878 that Eldred claimed to have first used the clearing-out drop in the Chicago exchange. The defendants, on the contrary, asserted that Eldred did not discover the clearing-out drop, nor apply it in use upon the board of this company, but that on the contrary it was discovered and first introduced into use by others after Eldred had left the employ of the company and had gone East.

In order to establish this defense, it became necessary to scour the country for witnesses, who were brought at great expense to the place of trial. It was established very clearly and beyond all reasonable doubt, that this man Eldred had, in fact, appropriated an invention made by another, and that the assertion made by him to the effect that the clearing-out drop was used in 1878 was false and without foundation.

The independent interests through the country should appreciate the importance of this decision, for it throws open to use the clearing-out drop and the calling drop; also the listening and ringing key, and power generator. It is evident that if this patent had been sustained, an injunction could have been obtained against every exchange throughout the United States, because all switchboards are equipped with listening keys and use the means claimed for extending a signal to the called subscriber. In very many, and in fact, almost all of the switchboards operated throughout the country by independent interests, the clearing-out drop is used, and the calling drop located in the manner claimed by the patent. This case is second in importance only to the suit on the Berliner patent for the transmitter, and inasmuch as the American Electric Telephone Company has fought it single-handed and won the victory at enormous expense, it should be given full measure of credit for the work and the victory.

C. C. BULKLEY,
Attorney for Defendants.

J. G. Ihmsen, general manager of the American Electric Telephone Company, when seen at the company's offices in regard to the above, said, "Yes, we have gained another important victory over the Western Electric Company. Our solicitor was notified by wire immediately upon the rendering of the decision, and I was advised by telephone a few minutes later. The final decision in our favor is most gratifying, and has removed a serious menace from the path of independent development. The average purchaser of telephone apparatus does not realize the importance of such matters, and will probably never display the slightest token of gratitude toward the company that has so vigorously defended his rights.

"If the 'Eldred' patent had been sustained there is not a telephone exchange operating within the jurisdiction of the United States patent laws that could have been continued. There is not a switchboard made by any manufacturer that does not infringe one or more of the claims of this alleged patent.

"We were not burdened with offers of assistance financially or otherwise in defending the suit. There was no frantic rush amongst the switchboard manufacturers to aid us. We did not receive a contribution from the National Telephone Association or any other association. Not a single manufacturer volunteered to assist in the defense.

"The American Electric Telephone Company alone is responsible for the existing conditions that make it possible for the independent telephone exchanges throughout the country to continue the business unmolested while using listening keys, clearing-out drops and power generators upon their switchboards in the manner described.

"I take this opportunity on behalf of our company to publicly thank counsel in the case, and our loyal friends at Grand Rapids for their untiring efforts and congratulate them upon the result.

"Unquestionably the January TELEPHONY is the best number of a telephone trade paper I have ever seen.

"CHAS. C. CADDEN,
"Cleveland, Ohio."

THE ROMANCE OF THE TELEPHONE — Cont'd.

BY JOHN PAUL BOCOCK.

(Courtesy of Frank A. Munsey.)

His application was formally "placed in interference with"—that is, declared apparently to conflict with—the patent of Bell and the applications of Edison, Gray, Dolbear, Richmond and Holcombe. The examiner, the first official to pass on the McDonough receiver, awarded him the priority. And there, for a moment, fortune shook her horn of plenty over his head. But the examiner-in-chief promptly reversed the decision, and his reversal has stood unshaken. Yet McDonough, who began experimenting in 1867, before Bell ever thought about a telephone, had by June, 1875, completed, by the help of the Reis transmitter, an apparatus "which was successfully employed for the transmission of articulate speech on many occasions during the same month," according to Professor E. J. Houston of the Franklin Institute.

But, say the Patent Office experts and the United States courts, McDonough used a Reis transmitter, he employed a make and break current to transmit speech, instead of the undulating current discovered by Bell, and Bell only; and therefore we cannot recognize McDonough's claims, for the undulating current is the only one which will transmit human speech. In other words, you may talk as much as you like through a Reis transmitter into a McDonough receiver, but the courts of the United States will not admit the existence of your talk, or even the possibility of its existence, because they once decided that only the (Bell) undulating current can transmit human speech, and that decision must and shall stand.

So what chance had Professor Amos E. Dolbear against the Medes and Persians of Washington? Professor Houston declares that "the experiments of this gentleman in telephony were contemporaneous with those of Bell and cover a wide field of research." He unquestionably invented the electrostatic telephone, and "did much to give commercial efficiency to the telephone." But he didn't pay enough attention to the Patent Office!

And poor Drawbaugh, the most pathetic figure of them all, what chance had he, a humble mechanic, experimenting for years in his shop at Eberly's Mill, Pennsylvania, knowing nothing of Reis, but telling his neighbors forty years ago that speech could be conveyed by electricity; and then, in the next seven years, according to their sworn evidence, actually constructing an apparatus which did transmit speech electrically, by an undulating current, it was claimed, from a table tumbler transmitter to a tin can receiver? What chance did he have, in his poverty, too poor to push his claims, too poor even to go to Washington—against the world, and the Patent Office?

Professor Gray's disappointment has been the most bitter of all, in some respects. His rank in the scientific world gave him great advantage. Such an expert as Houston says of him that "he is clearly entitled at least to share with Bell the honor for the invention." As long as he lives, and his family live, the honors and the enormous wealth that were so nearly in his grasp will not be forgotten. All of which points inevitably to the prologue of the play, the story that the telephone had already been invented in Germany more than twenty years before the Centennial year by Philip Reis, who may truthfully be described as a martyr to science, and upon whose tombstone at Friedrichsdorf may be seen to this day the singularly pathetic sentence, "Erfinder des Telephons." The epitaph is pathetic, because the life of John Philip Reis was itself a tragedy. He was born on January 7, 1834, at Gelnhausen, near Frankfort, and his father, a master baker, spared no means at hand for the lad's education. His lungs were weak, his health delicate, his application to his studies incessant. He came across a copy of the French Journal "L'Illustration" of August 26, 1854, in which a young French telegrapher, Charles Bourseul, published a plan for the transmission of sound (not speech) by a "make and break" electric current. This emphasized the direction of Reis' mechanical studies. He constructed an electrical apparatus consisting of a transmitter and a receiver connected by a telegraph wire, in which "each sound wave," as he described it, "caused a breaking and closing of the current."

The whole telephone controversy turns to some extent on what Reis did with this apparatus after he devised it. Bell says the instrument was "a musical toy;" that it reproduced musical pitch and no more. Professor Paddock of the Stevens Polytechnic Institute stated under oath in the patent suits, that he could and did "talk over the Reis apparatus." The Bell lawyers, the ablest money could retain in this country, have always insisted that Reis did not aim at inventing a speaking telephone and did not invent one, although they concede that Bell's invention applied to the Reis apparatus makes the latter a speaking telephone. But Professor Silvanus P. Thompson, now holding the chair of experimental physics in University College, Bristol, England, declares deliberately not only that Philip Reis was "the inventor of the telephone," but goes so far as to say that "Reis' telephone was expressly intended to transmit speech; it did transmit speech; it will transmit speech" if made to-day according to the inventor's instructions. Professor Houston of the Franklin Institute says that the Reis telephone could and did transmit articulate speech.

Some Bell advocates say, "Reis did invent a speaking telephone, but he did not know it." Contemporary publications show that Reis "publicly exhibited" his instrument from 1861 to 1864, lectured on it and practically devoted his life to it. There is no sort of doubt that he originated the name "telephone" and applied it in the year 1860 to the most important part of his apparatus, the transmitter.

Now, the transmitter is still the most important part of the telephone. It was the Blake transmitter that made the Bell telephone commercially valuable. It is the patent on the Berliner transmitter that has held the anti-Bell world at bay since the Bell patents expired. It was the Edison transmitter, patenting the use of carbon, which perfected the discoveries and appliances of Bell and Berliner. Those three—Bell, Berliner and Edison—are the men whom the electrical world of to-day, or the vast majority of its representatives, regard as the telephone trinity. What is one to think of Professor Thompson, whose integrity and scientific ability no American expert can deny, when he asserts that "all transmitters" utilize Reis' fundamental principles; that "they come back to Reis' fundamental idea" of "setting the voice to vary the degree of contact in a mechanism which he called an interrupter." Reis used a "tympanum," or drum, like the ear drum, in his transmitter. Gray speaks of a "tympanum" in his caveat. Bell describes the same thing as "stretched membrane" in his application. They simply followed in Reis' footsteps, according to Professor Thompson, who has already been quoted. What is more, Professor Thompson affirms that Bell's crowning achievement, his one vital contribution to the composite telephone as we know it to-day, "the undulatory current," was known to and used by Reis.

Of course if the United States courts believed with Professor Thompson and believed that Mr. Bell knew of Reis' discoveries and their publication, the whole telephone situation would be different; the Bell patents would never have been issued. The hundred million dollar chest would have no gold in it.

Reis died January 14, 1874; the Bell patent was applied for February 14, 1876. And what a death this young German enthusiast met, after all! He, the "Erfinder des Telephons," the discoverer, some say, of the art of electrically transmitting speech, to lose his voice and die of the breaking down of the organs of speech!

Bell and Gray were both educated men. Would it not be strange that neither one of them had read or heard of the Reis telephone? The European world of science knew all about it. Bell had even been to Germany, prosecuting his studies in deaf and dumb language, in which he was an expert. His father and grandfather before him had been teachers of languages. As a youth in Edinburgh—where he was born March 3, 1847—he had learned the anatomy of the vocal organs, and, according to his own account, had built an automaton speaking machine. At this very time Reis was lecturing before the Physical Society of Frankfort on the Main. No. 15 of Bottger's Polytechnic Notizblatt, published in 1863, declares that persons using "the Reis telephone could even communicate to each other words, only such, however, as they had already heard frequently."

Bell and Gray must surely have known all about the Reis telephone. But Bell denied it, in court, although he admitted that he had read parts of a German book in which the Reis telephone was described.

In 1870 Mr. Bell emigrated to Canada, in 1871 to Boston, all the while studying and experimenting in the deaf and dumb language and in the transmission of speech, as he says. One would think that the Reis telephone in the Smithsonian Institute might excite the liveliest interest in his mind. His friends say Bell "was not the first who tried to invent a speaking telephone, but he was the first who did." But it was Gray, in his caveat, who made the first claim to this invention—"I have invented a new art of transmitting vocal sounds telegraphically."

The Bell telephone, as exhibited in 1876, excited only passing interest among the wonders of the Centennial. The transmitter was not reliable; you never knew whether you were going to hear a buzz, a break or a word. Mr. Edward S. Renwick, the well-known New York expert, brother of the architect who designed St. Patrick's Cathedral, swore in court—in one of the telephone suits whose name is always Bell against somebody or other, and whose pages of evidence are legion—that he, Renwick, made a pair of Bell telephones according to Bell specifications, and that they would not transmit speech. As late as the summer of 1878, when the Bell Telephone Company, for convenience' sake, moved from New York to Boston, its future seemed dark and uncertain. The assistant secretaryship of the Bell company was offered to a New York newspaper reporter if he would go to Boston. He did not think well of the proposition, surmising that his pay would be in stock, for the company sadly lacked money. A single share of such stock as he would then have received is now worth from twenty-five to thirty thousand dollars. The original stock has been watered and watered over again, expanded and inflated, paying dividends and extra dividends, with tremendous legal expenses, and is still piling up millions besides.

It was in those troublous days, when the Bell transmitter would not work properly, and the Bell company had no money in its treasury, that the manufacturing firm of E. S. Greeley & Co. were asked to make Bell telephones for the owners of the patent. They looked askance at the proposition; they were in the habit of receiving cash, and plenty of it, for their work. So the Bell Telephone Company applied to Charles L. Williams, Jr., of Boston, and when his bill became due, paid him in stock, "the supposed equivalent" of the cash. More bills were paid in stock, and Mr. Williams acquired quite a lot of it; he tried to sell some of it at twenty-five cents on the dollar, but nobody wanted to buy it, and so the Williams stock was laid away.

Francis Blake, a bright young man who afterwards entered the service of the Bell company, invented a new kind of transmitter, which the Bell concern acquired the exclusive right to make. Bell telephones with Blake transmitters were introduced as if by magic into every big city in the United States. Their value was instantly recognized. The stock went up by long leaps. Mr. Williams of Boston was one of those now able to pull a trunk full of stock from under the bed. He got three shares of new stock for each of his original shares, and the dividends on his new stock made him a very rich man. Mr. Blake at once began to reap his reward. He is declared to have "made telephony an art."

Here Berliner and Edison come into the story of the telephone. Emil Berliner, born in Hanover in 1851, came to the United States in 1870, friendless, craving knowledge, looking for opportunities. He worked for a German druggist in New York. One day his master gave him an old copy of Müller's "Physik." While he was intent upon this, he found La Cour's "Researches in Phonic Wheels" on an old book stand. The idea of transmitting human speech by electricity began to burn in his brain. In the Centennial year he went to Washington, where he became a clerk in a dry goods shop; but he never relaxed his devotion to his electrical and telegraphic studies.

He was standing at the key one day when an operator named Richards said to him "You'll have to press down harder, or it may happen that the sounder at the other end will not respond well." The thought at once flashed through Berliner's mind that if pressure modified the electrical current, by making this difference in the contact, a vibratory contact would transmit human speech—since sound waves are undulations—by a vibratory current. He at once began experimenting with a transmitter of his own devising and a Bell receiver. In his transmitter he used a metallic diaphragm touching screws tipped with broken lead pencil points. He also conceived the idea of placing his transmitter in the primary of an induction coil, and got a patent for that. The value of his discoveries was at once recognized, and he was invited to join the staff of the Bell Telephone Company. But his invention did not become that company's property as yet.

Berliner is always spoken of as one of the three telephone discoverers. "If," said the Bell company in the brief in support of its complaint against the National Telephone Company, in the case heard in Boston in November, 1899—"if Berliner and Edison are to be regarded as rival inventors of the telephone, Berliner is plainly the prior inventor, as he clearly conceived the invention in January, 1877, and completed it in April, 1877, by filing the description of his caveat. . . . Berliner was the first to conceive the microphonic principle." This principle, "constant contact, variable pressure," enabling the electric current to transmute the undulations of the voice into electrical undulations, was Berliner's discovery, ranking second in telephone science to Bell's of the undulatory current itself. Reis called his transmitter the "telephone;" that is why Berliner's wonderful improvement over Bell's transmitter justifies Berliner's being called one of the "inventors of the telephone."

Although Berliner applied for his patent in 1877, it was not issued until 1891. The sinister influence of the Bell Telephone Company is declared to have been responsible for this delay.

(Concluded in the March TELEPHONY.)

(Continued from page 45.)

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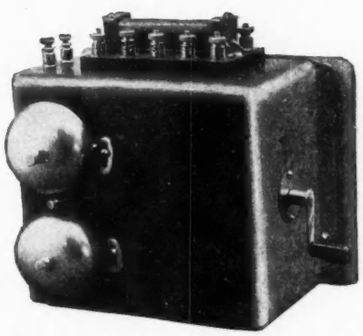

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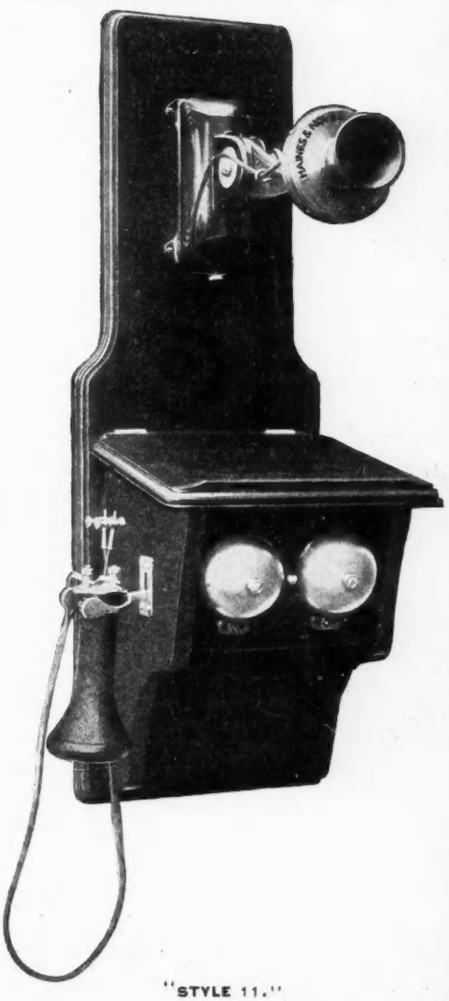

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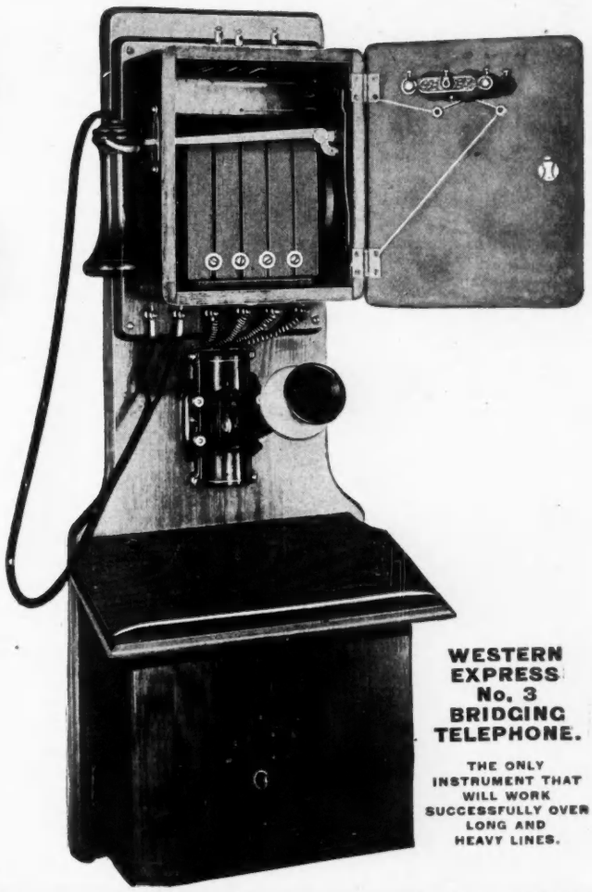

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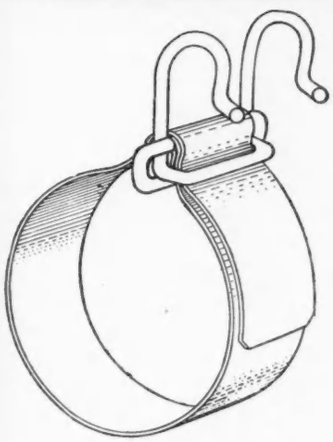

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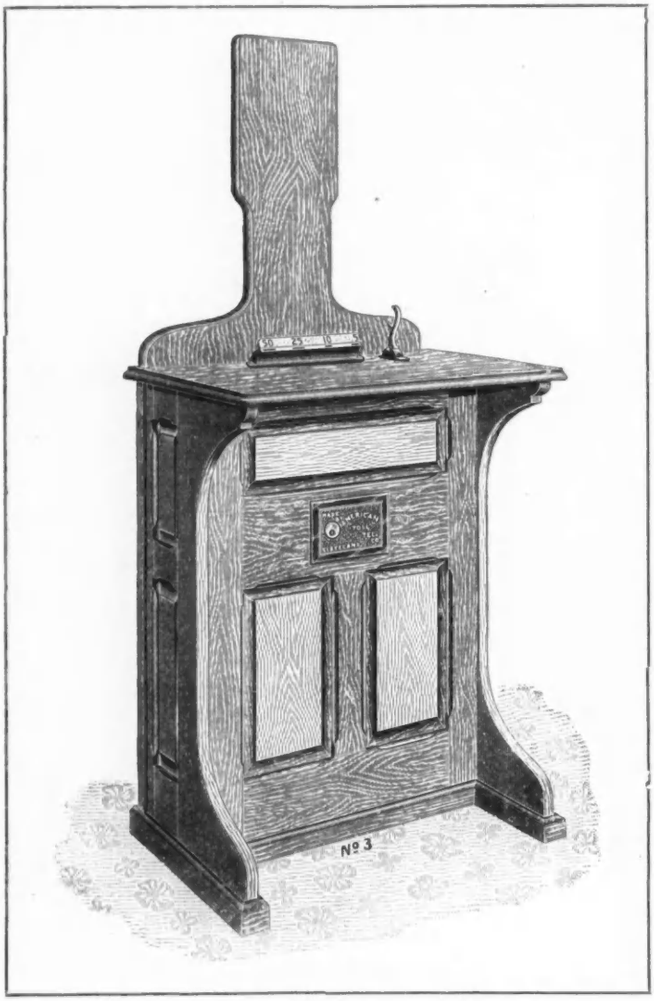

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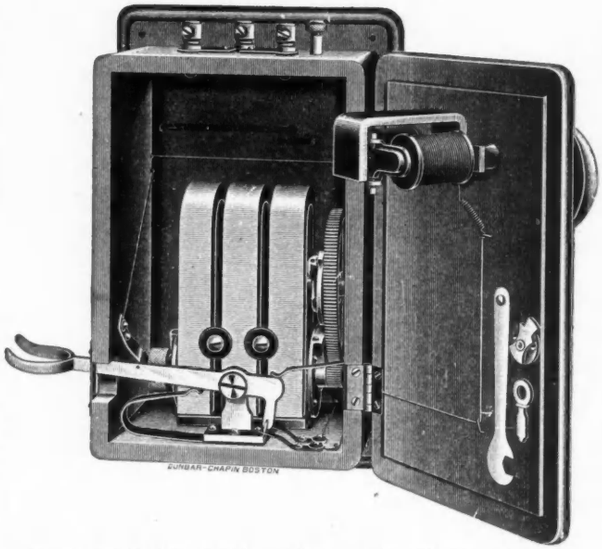

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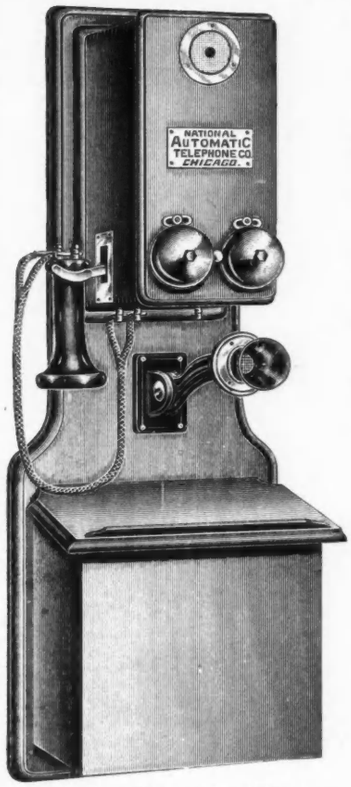

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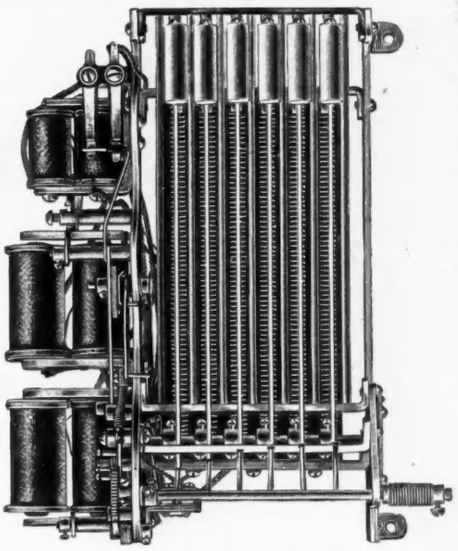

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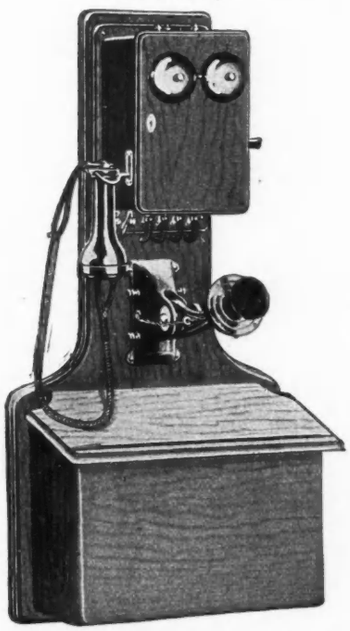

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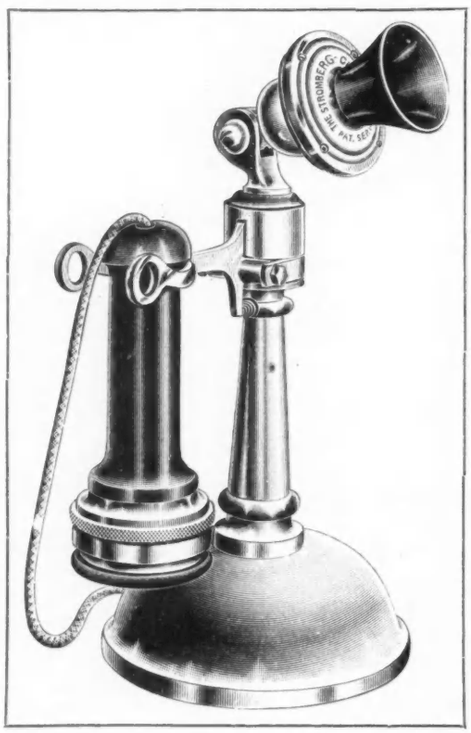

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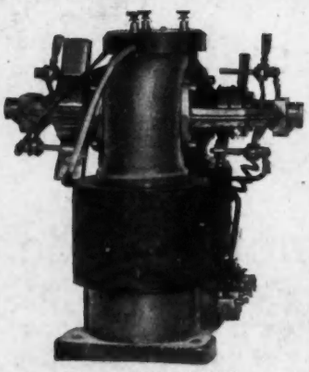

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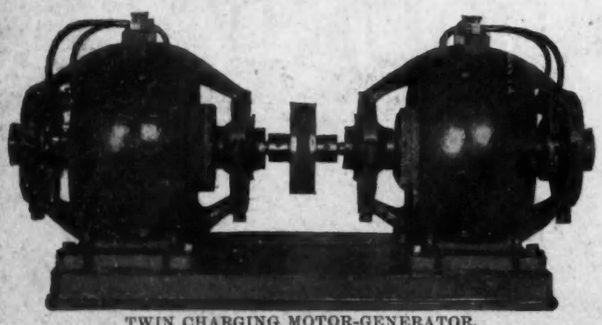

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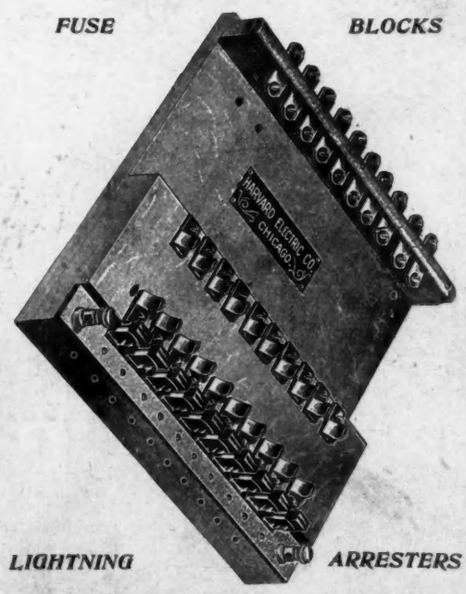

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